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Effects of Voltage Control in Utility Interactive Dispersed Storage and Generation Systems

H. Kirkham
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ABSTRACT

When a small generator is connected to the distribution system, the voltage at the point of interconnection is determined largely by the system and not the generator. This report examines the effect on the generator, on the load voltage and on the distribution system of a number of different voltage control strategies in the generator. Synchronous generators with three kinds of exciter control are considered, as well as induction generators and dc/ac inverters, with and without capacitor compensation. The effect of varying input power during operation (which may be experienced by generators based on renewable resources) is explored, as well as the effect of connecting and disconnecting the generator at ten percent of its rated power.

Operation with a constant slightly lagging power factor is shown to have some advantages.

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SECTION 1

INTRODUCTION

DSG Voltage Control

Dispersed Storage and Generation (DSG) Systems such as hydroelectric, solar thermal electric, photovoltaic, wind, storage battery, hydroelectric pumped storage and co-generation systems have some common and some distinctive attributes. Three attributes that DSGs have in common are: (1) their kW size is small compared to the kW size of conventional utility plants, (2) they may not be available as a source of constant power throughout the day and (3) they can only be economically connected to the distribution system or to the subtransmission system of a large utility network. Three attributes which tend to make DSGs different from one another are: (1) some of DSG technologies are proven while others are still maturing, (2) some DSG technologies use conventional turbine-generators for energy conversion while others use electronic ac-dc-ac or dc-dc conversion to obtain utility-grade ac power, and (3) their individual control systems are quite different. Of course, cost factors may also differ significantly.

Based on these commonalities and differences among DSG technologies, it is evident that, for a significant penetration, a large number of these DSGs will be required and connected at the distribution or subtransmission level of the utility power system. Their individual and aggregate behavior during system steady-state or transient conditions will be different, and their desirability or value as a source of power in terms of busbar energy cost ($\$/kW_e h$) will be different since this cost is dependent on the status and type of technology used in energy conversion.

The flow of real and reactive power is related to frequency and voltage. If a DSG has independent voltage control capability, it can be operated cooperatively with any method of voltage control on the existing power system. If the DSG is small, this can be done by local measurements and local control alone. Keeping the generation or consumption of reactive power within reasonable limits may be a sufficient control algorithm.

The effects of voltage control in a power system with large generating plants are routinely studied. However, DSGs present a new class of problems since their size is small, since there may be a large multiplicity of them scattered around the distribution network and their terminal characteristics at the point of inter-connection may be distinctly different from those of conventional generators. A study of the effect of DSG voltage control has not been performed in any detail.

The objective of this study is to examine the effects of voltage control in utility-interactive DSGs. To that end, several DSG types have been mathematically represented according to certain assumptions and the impact of voltage control on real and reactive power flow and on power factor is evaluated.

Relationship Between Voltage and Reactive Power

Consider an ac generator with output voltage $E\angle\delta$ supplying real power P, and reactive power Q, to a load over a line of impedance R+jX at a terminal voltage, $V\angle 0$, as shown in Figure 1-1. The relationship between the various quantities is shown in the vector diagram of Figure 1-2.

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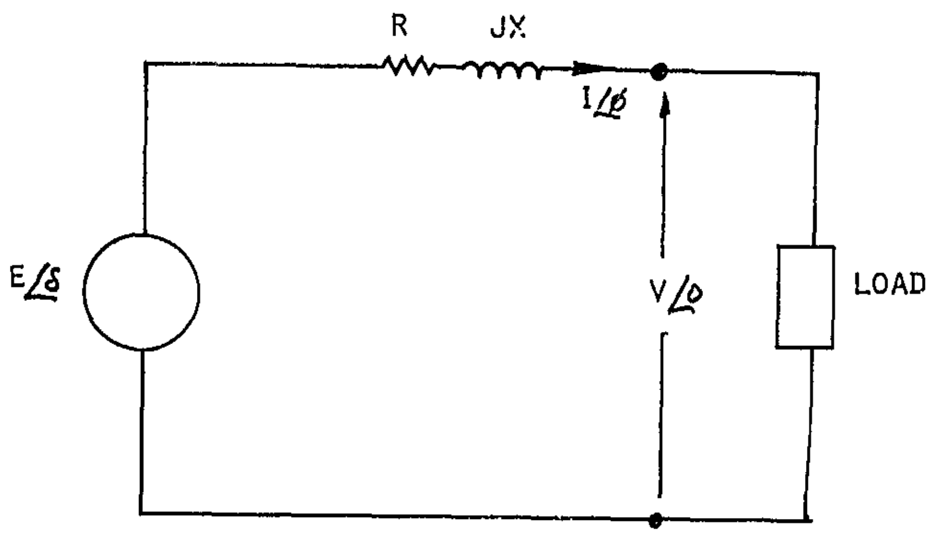

Figure 1-1. An ac Generator Supplying Power to a Load

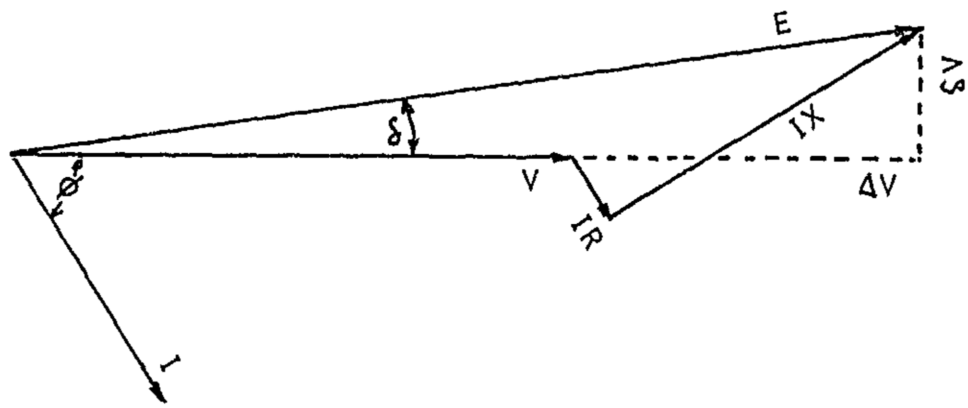

Figure 1-2. Vector Diagram for Circuit of Figure 1-1

From Figures 1-1 and 1-2, it is found that

$$E^2 = (V + RI \cos \phi + XI \sin \phi)^2 + (XI \cos \phi - RI \sin \phi)^2$$

where ϕ is the power factor angle and I is the load current.

But $\qquad P = VI \cos \phi$

and $\qquad Q = VI \sin \phi$

Therefore,

$$E^2 = (V + \frac{RP + XQ}{V})^2 + (\frac{XP - RQ}{V})^2$$

For small δ, $V + \Delta V > \delta V$

Therefore, $\qquad E \simeq V + \frac{RP + XQ}{V}$,

and $\qquad \Delta V = E - V \sim \frac{RP + XQ}{V} \qquad (1.1)$

Also, $\qquad \delta \simeq \sin^{-1} (\frac{XP - RQ}{VE})$

When R = 0 and E is fixed, using equation 1.1 it can be shown that

$$V = \frac{E + (E^2 - 4XQ)^{1/2}}{2}$$

or $\qquad V \simeq E - \frac{QX}{E} \qquad (1.2)$

Therefore from equations 1.1 or 1.2, it is evident that the reactive power flow determines the voltage profile throughout the power system. Conversely, the voltage control is equivalent to control of reactive power flow in a power system. They are interrelated.

Whenever the magnitude of a particular bus voltage is changed, Q-balance at that bus is disturbed. That is, if there is a change in Q demand at the bus, this demand must be matched locally at the bus if the voltage profile is to be maintained.

Relationship Between Power and Frequency

Constant impedance loads and composite loads vary with voltage and frequency. Their behavior can be described as follows [1-1]

$$P = P(f, |V|)$$

$$Q = Q(f, |V|)$$

Therefore, changes in real and reactive power caused by small variations in frequency and voltage can be obtained by expressions

$$\Delta P = \frac{\partial P}{\partial f} \cdot \Delta f + \frac{\partial P}{\partial |V|} \cdot \Delta |V| \quad (1.3)$$

and

$$\Delta Q = \frac{\partial Q}{\partial f} \cdot \Delta f + \frac{\partial Q}{\partial |V|} \cdot \Delta |V| \quad (1.4)$$

The exact values of the partial derivatives in 1.3 and 1.4 will depend on the type of load. For incandescent lamps there is a considerable variation in efficiency with applied voltage. It is commonly assumed that for a tungsten filament incandescent lamp a 10% reduction in rated voltage will result in a light output of 70% of rated value and a power consumption of 85% of rated. With a 10% increase in voltage the output and power consumption increase to roughly 140% and 115%, respectively.

Fluorescent lamps are not nearly so sensitive to applied voltage. Roughly speaking, a one percent change above or below the rated voltage will produce a one percent change in light output and power consumption. Below about 90% there may be difficulty starting the fluorescent lamp and above about 110% there may be an overheating problem.

Resistance heaters are very nearly constant resistance, so that the energy input to such devices varies very nearly as the square of the applied voltage. Devices in this category would include the resistance heaters used for home heating and home cooking as well as for electric clothes drying and, in industry, for various forms of process heat.

Induction motors are particularly sensitive to applied voltage in terms of the starting torque and starting current, but since the present study is concerned more with their steady-state performance it may noted that their full load current decreases with increasing applied voltage such that a 10% increase in applied voltage may result in a 10 to 15% decrease in the full load current. There may also be some change in slip although this will not directly affect the power consumed.

Synchronous motors are not particularly sensitive to the applied voltage in terms of their power consumption since their speed and, hence, power are fixed exactly by the frequency of the power system, but their reactive demand may increase or decrease in a manner similar to that for synchronous generators. It is difficult to go into more detail for this kind of load.

For composite loads, the four partial derivatives of equations 1.3 and 1.4 must be evaluated empirically, since their values can not be determined analytically. Studies with a typical composite load consisting of some induction motors, some synchronous motors and various other loads indicate the following average approximate values of three partial derivatives.

$$\frac{\partial P}{\partial |V|} \sim 1.0 \text{ percent/percent}$$

$$\frac{\partial Q}{\partial |V|} \sim 1.3, \quad \frac{\partial P}{\partial f} \sim 1.0$$

The value of the fourth derivative is not available and is of less practical importance.

Figure 1.3 shows typical variations of real and reactive powers with the voltage for a composite load on a power system. In typical power systems, power station operators control generator output voltage by fixing the field current. The output power is determined by the amount of mechanical energy being supplied to the generator. The power grid is fed through the specification of generator power and voltage while a load, in a statistical sense, is characterized by its power requirements.

It is the function of governor or its equivalent control system to keep the frequency variations within a small range. Since DSGs under consideration in this report will be utility interactive, it is assumed that the frequency will be controlled by the utility and it will remain nearly constant. Therefore, frequency variations will not be considered in this study.

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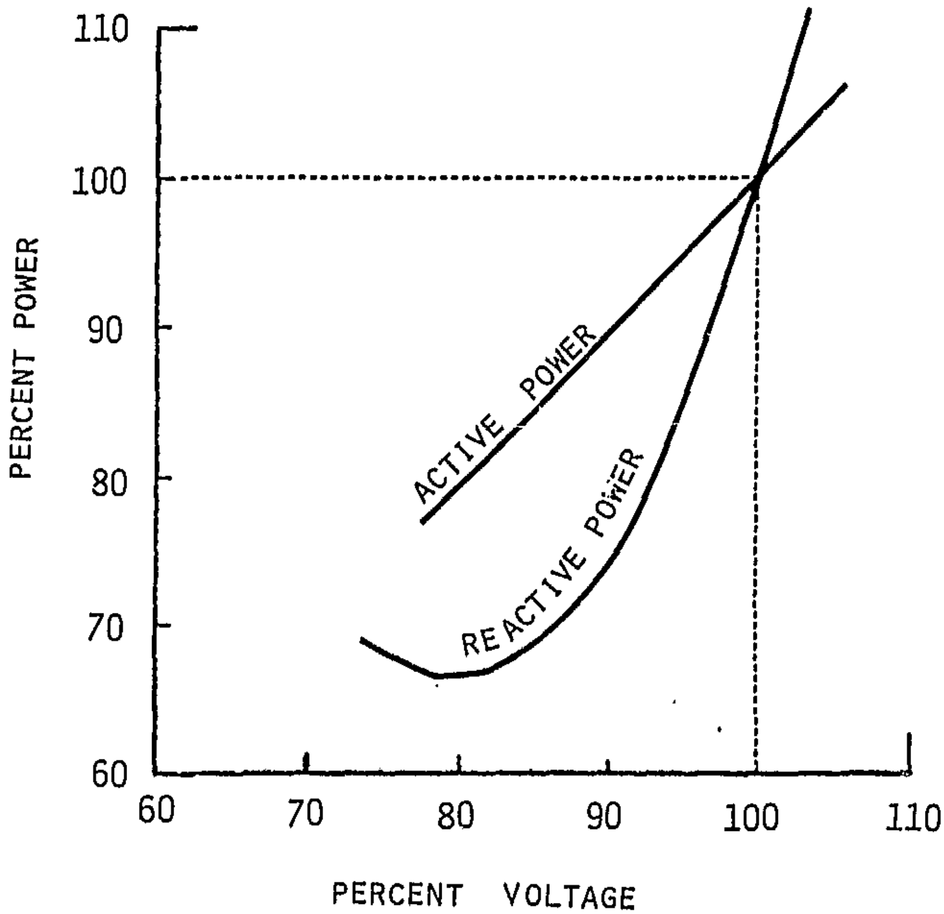


Figure 1-3. Typical Power/Voltage Characteristics of Power System Load

Load Flow Problems: General Approach

The term 'load flow problem' refers to steady state calculations that provide power flows and voltages for a specified power system subject to constraints imposed by regulating capability of generators, condensers and tap changing transformers as well as net interchanges among individual operating systems. Load flow studies are performed for planning purposes and may encompass either normal or emergency operating conditions.

The normal type of power system load flow solution cannot be employed for our present study because the method used typically requires that the load be specified in terms of real and reactive power consumption and the generators be similarly specified. At some busses a voltage may be specified and there may be within the system a slack bus at which only voltage magnitude and phase angle are specified. A generator is typically connected to such a bus to make up whatever real and reactive power is required at that location. However, in the present study there are somewhat fewer degrees of freedom and the additional constraint of a voltage controller or exciter equation must be taken care of. Nevertheless, an iterative solution is still required. In order to illustrate the issues involved consider the system shown in Figure 1-4. This example is taken from a power systems text book presently being written by Harold Kirkham of the Jet Propulsion Laboratory, Walter J. Gajda Jr., of the University of Notre Dame and Radhe S. L. Das of California State University, Long Beach.

In the example, there are two generators, a single load, and two resistors which represent ohmic losses in the transmission system.

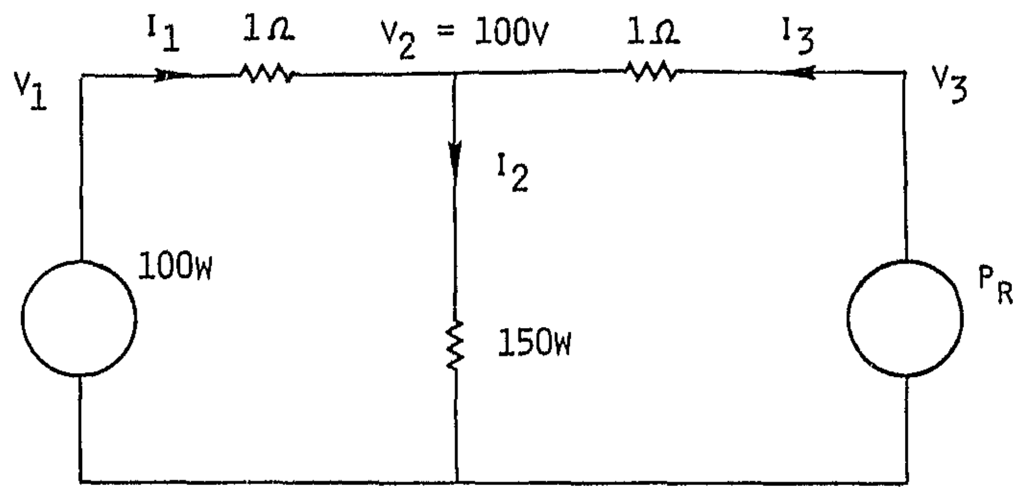


Figure 1-4. Power System Circuit Diagram and Values Used To Illustrate Solution Method

Figure 1-4 is a dc example for simplicity. As a problem in conventional network analysis with the source voltages and resistance values specified, this is a rather straightforward problem. However, as a power system problem, analysis is rather circuitous.

One may begin by specifying that:

a. The left generator will put out 100 watts and,

b. Load must receive 150 watts at 100 volts.

It may noted that this is not the normal way to specify a network analysis problem, but such specification would not be unusual in a power system. The problem is to determine both voltages V_1 and V_3 and the power developed by right generator P_r. When these three quantities are known, the operation of the generators will be completely specified in that the operator would know the field currents and powers required to satisfy the load.

The load current is

$$I_2 = \frac{150W}{100V} = 1.5A$$

Two expressions can be written for I_1.

$$I_1 = \frac{100W}{V_1} = \frac{V_1 - V_2}{1} = \frac{V_1 - 100}{1}$$

The voltage, V_1, of the left generator is uniquely specified because

$$\frac{100}{V_1} = V_1 - 100$$

or

$$V_1^2 - 100\ V_1 - 100 = 0$$

This may be solved directly

$$V_1 = 100.99$$

Of course,

$$I_1 = \frac{100}{V_1} = .99A$$

By Kirchoff's Current Law

$$I_2 = I_1 + I_3 \text{ and we solve } I_3$$

$$I_3 = I_2 - I_1 = 1.5 - .99 = .51A$$

Further

$$V_3 = V_2 + (1\text{ ohm})(I_3) = 100.51V$$

Now the right generator's output can be found

$$P_r = V_3 I_3 = 51.26W$$

The system model is completely analyzed. Power flows are:

Power-generated = 100 + 51.26 = 151.26W.

Power absorbed = P load + P losses
= 150 + .98 + .26
= 151.24W.

These values balance to within the accuracy of the calculations.

The operator of the right generator must burn sufficient fuel to yield an electrical generation rate of 51.26 watts. In addition, he must supply field current to hold V_3 at 100.51 volts. The operator of the left generator must supply 100 watts at 100.99 volts.

There are five degrees of freedom in the circuit to Figure 1-4. By this is meant that the specification of five independent quantities serves to totally determine the behavior of the circuit. In the most familiar terms, these five quantities consist of the values of the two line resistances, the load resistance, and the two generator voltages. When these are specified, the powers and currents are determined. This observation can be generalized to the recognition that there are b degrees of freedom in a circuit made of b elements. In the power system above, the circuit was characterized by five values (as is essential if the unique solution is to be found) which were not traditional. These consisted of the power of the left generator, load power and voltage, and the two line resistances. The problem was then completely characterized and it was possible to solve for the other voltages, currents, and powers of interest.

The five values chosen to specify the problem are somewhat arbitrary although they must be independent, that is, any one of them must not be determined by any combination of the other four. For example, three of the quantities could not be the voltage, current and resistance associated with one of the transmission lines since these three do not form a set of independent quantities. Specification of any two will serve to fix the third.

The apparent arbitrary nature of the initial choice of five quantities is further amplified via another analysis of the same circuit specified differently as sketched in Figure 1-5. The analysis begins with knowledge of the power generated by the left generator, the two line resistances, the power absorbed by the load and the voltage associated with the right generator. The method proceeds in a straightforward fashion with a determination of the power to be supplied by the right generator and the two remaining node voltages, V_1 and V_2.

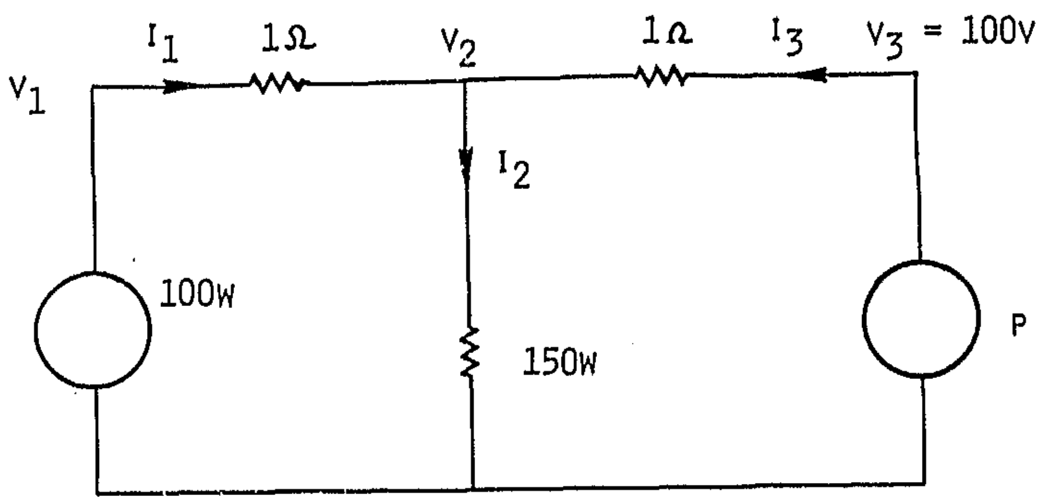


Figure 1-5. Power System Circuit Diagram and Values Used To Illustrate Solution Method

$$I_3 = \frac{P}{100}$$

$$V_2 = 100 - I_3$$

$$= 100 - \frac{P}{100}$$

$$P_{load} = V_2 I_2 = 150$$

$$I_2 = \frac{150}{100 - P/100}$$

$$I_1 = I_2 - I_3 = (150/(100-P/100)) - P/100$$

$$V_1 = V_2 + I_1 = (100-P/100) + (150/(100-P/100)) - P/100$$

$$P_{left} = 100 = V_1 I_1$$

Substituting for V_1 I_1 in this equation yields one equation involving P, and it can be used to determine the right generator's power output. The equation is a fourth order polynomial in P, and numerical evaluation leads to

$$P = 51.25 \text{ watts}$$

The other values follow immediately:

I_3 = .5125 amps

V_2 = 99.487 volts

I_2 = 1.5077 amps

I_1 = .9952 amps

V_1 = 100.483 volts

The analytic complexity of the solution is masked by the few lines above indicating that the equation is a fourth order polynomial in P. Other methods of circuit analysis also lead to complex expressions. In short, although this second problem appears to be a minor variation of the first, and indeed the final values for current voltage and power are not significantly different, the mathematical complexity is such as to require numerical techniques. If the problem is extended to the ac equivalent, the complexity of the solution becomes even greater and numerical techniques would become even more necessary.

Solution Methods

Three types of DSG systems were considered: (1) DSGs using synchronous generators (e.g., solar thermal electric generating system), (2) DSGs using induction generators (e.g., wind systems), and (3) DSGs using dc/ac inverters (e.g., photovoltaic system). Steady-state mathematical models for each DSG system were used and effects of varying performance parameters on load terminal voltage and system VARs were evaluated.

For each DSG system, some reasonable performance conditions are assumed. In order to obtain a complete set of solutions for the system equations, the value of one or two variables is guessed and values of all variables are obtained iteratively.

Usually the value of system voltage was guessed sometimes along with one other system variable. In some generator models, knowledge of the terminal voltage of the machine completely specified the conditions inside the machine. For example, a synchronous machine controlled with an exciter using voltage feedback operates so that the magnitude of the exciter voltage is completely specified by the terminal voltage. The machine power angle delta is the only parameter which can vary to accommodate the required power output from the machine. Similarly, in the case of an induction machine, the model of the generator consists entirely of passive components, and conventional network analysis can be used to solve for the various current flows, given the terminal voltage on the machine and adjusting the slip so as to accommodate the appropriate power output.

In some of the generators, knowledge of the terminal voltage does not specify the conditions within the generator, and in these cases the second parameter guessed at would be the angle between the voltage behind system reactance and terminal voltage. This angle is frequently called beta. In such cases, the program iterated on the initial guessed terminal voltage and on the value of beta so as to obtain convergence.

In terms of the analytical complexity of the solution as indicated above, several of the combined generator load and power system models have 10 degrees of freedom and present sufficient complexity to completely rule out the idea of developing closed form solutions.

SECTION TWO

MATHEMATICAL MODELS

General Assumptions

In the previous section it was shown that the power system problem must ordinarily be solved iteratively, and methods of doing so were discussed.

If reasonable assumptions are made about the efficiency of the DSG, it might be possible to describe the variation of output power with input power. However, the variation of the output voltage cannot be handled so easily. In the usual power system solution, loads and generators are described by their real and reactive demands, and for the DSGs studied here these parameters are not known. Consequently, it becomes necessary to model each DSG, load and power system as a complete electrical circuit (rather than a one-line diagram) and to solve it using the equations of circuit analysis.

The remainder of this section will discuss the various models used and the numerical techniques used to solve the system problem.

Power System Model

Most portions of the generation side of a power system can be represented, for circuit analysis, by a very simple Thevenin equivalent. For generation and transmission this equivalent would simply be an inductance in series with a voltage source, as shown in Figure 2-1.

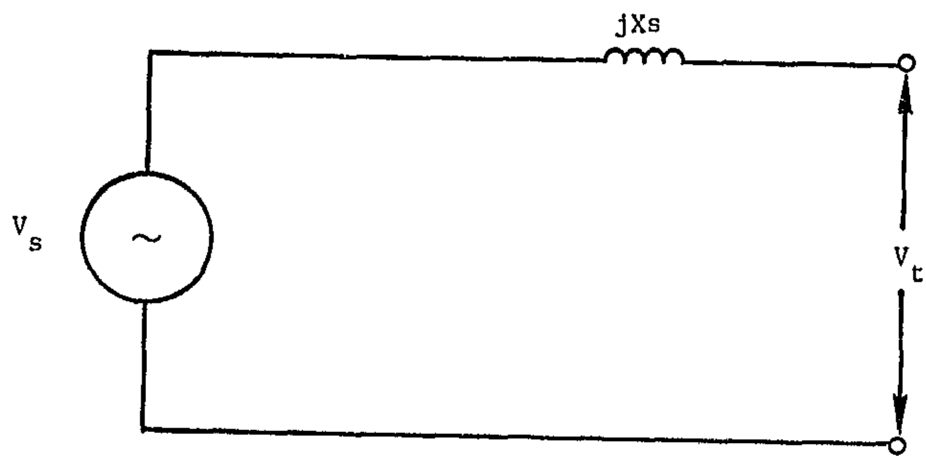


Figure 2-1. Thevenin Equivalent for Generation or Transmission System

Distribution systems differ in a number of ways from transmission systems. They are generally much less interconnected (with some exceptions) and the equivalent circuit frequently contains an appreciable resistance. Voltage control is rarely applied at the load, but is frequently applied at distribution substations and along some feeders .

If we assume that the load under consideration is connected somewhere along a feeder (at one point), the feeder may be represented by a complex impedance. The effect of voltage control can then be modelled by allowing the voltage source to take on a range of values. The arrangement is shown in Figure 2-2.

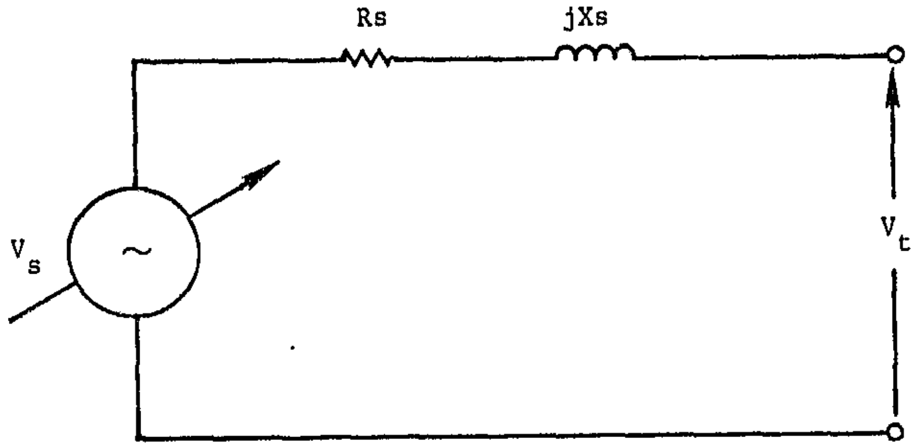


Figure 2-2. Equivalent Circuit for Distribution System

The parameter values in Figure 2-2 are chosen to be representative of a typical system, in per unit.

Since design practice of distribution systems varies widely, it is quite difficult to give representative values for the resistance and reactance of the power system as seen from the customer's terminals. Furthermore, design practice is usually based on consideration of voltage drop rather than system impedance as it would be in a transmission system.

Nevertheless some estimates of typical values can be made. The impedance of the distribution transformer might be in the order of 2 or 3 percent, the higher impedances being associated usually with the larger ratings. The distribution transformer impedance is mostly reactive, the resistive component being perhaps one quarter of the total impedance. To this complex impedance must be added an impedance representing the feeder and secondary line to the customer, and the service drop.

The feeder and service drops vary somewhat with line design, but circuit conductors typically have an R to X ratio in the order of one.[2-1] That is to say, they are equally resistive and reactive. The exact amount of resistance and reactance to be added in our model, of course, depends on the circuit design and the length of line between the distribution transformer (whose impedance was considered above) and the customer.

The values taken as representative of the sum of transformer reactance and line resistance and reactance in this study were R = .04 and X = 0.1 pu. The programs were also run with half this value as system impedance, producing results which were not substantially different. Some verification of the validity of these numbers may be obtained from consideration of volt drop, as is normally done in a distribution system design. In a residential feeder at heavy load there may be three-volts drop between the first distribution transformer and the last, and there may be three volts drop in the distribution transformer. Another three and one-half volts might be lost in the secondary line, and the service drop under (maximum) load for the consumer is rarely above one volt. This gives a total maximum volt drop on a residential feeder of 11 volts or .1 per unit. In the base case calculation of the studied power system where there is no DSG, the volt drop from the equivalent generator to the load at maximum load is about 9%, which is close to the maximum quoted above. The system is therefore quite representative of a distribution system and a typical customer. The alternate case results, with half this system impedance, might represent a customer connected closer to the distribution substation.

A rural feeder usually has about the same total volt drop as a residential feeder, but in the case of a rural feeder more of the volt drop exists across the primary feeder and service drop and there is, of course, typically no secondary line at all.

Load Model

In the solution of the single line version of the power system problem, the load is usually represented by a fixed real and reactive demand. However, since the voltage on a load bus may vary as the solution is approached, it is sometimes necessary to express the real and reactive loads as a function of voltage. Frequency effects can be neglected in the steady state load flow because governor action can be assumed to hold the frequency at its nominal value.

Clearly, the load performance will depend on the kind of load, as discussed in Section 1. For example, the real power demand of motor loads is practically independent of voltage, because the motor speed does not change with voltage. (There may be a very small change in the case of an induction motor.) Reactive demand will vary, however.

The real power demand of constant impedance load varies quadratically with voltage, as does the reactive demand.

Other loads have other properties, some being almost constant current for example, so that the problem of representing a load is by no means trivial.

Experimental investigations have shown that many aggregate loads can be represented as simple functions of voltage such as $P = kv^n$. Perhaps this is not too surprising, since for $n = 1$ this represents a linear function which lies between the quadratic dependence of constant impedance loads and the independence of motor loads. Figure 2-3 shows the effect of this load representation.

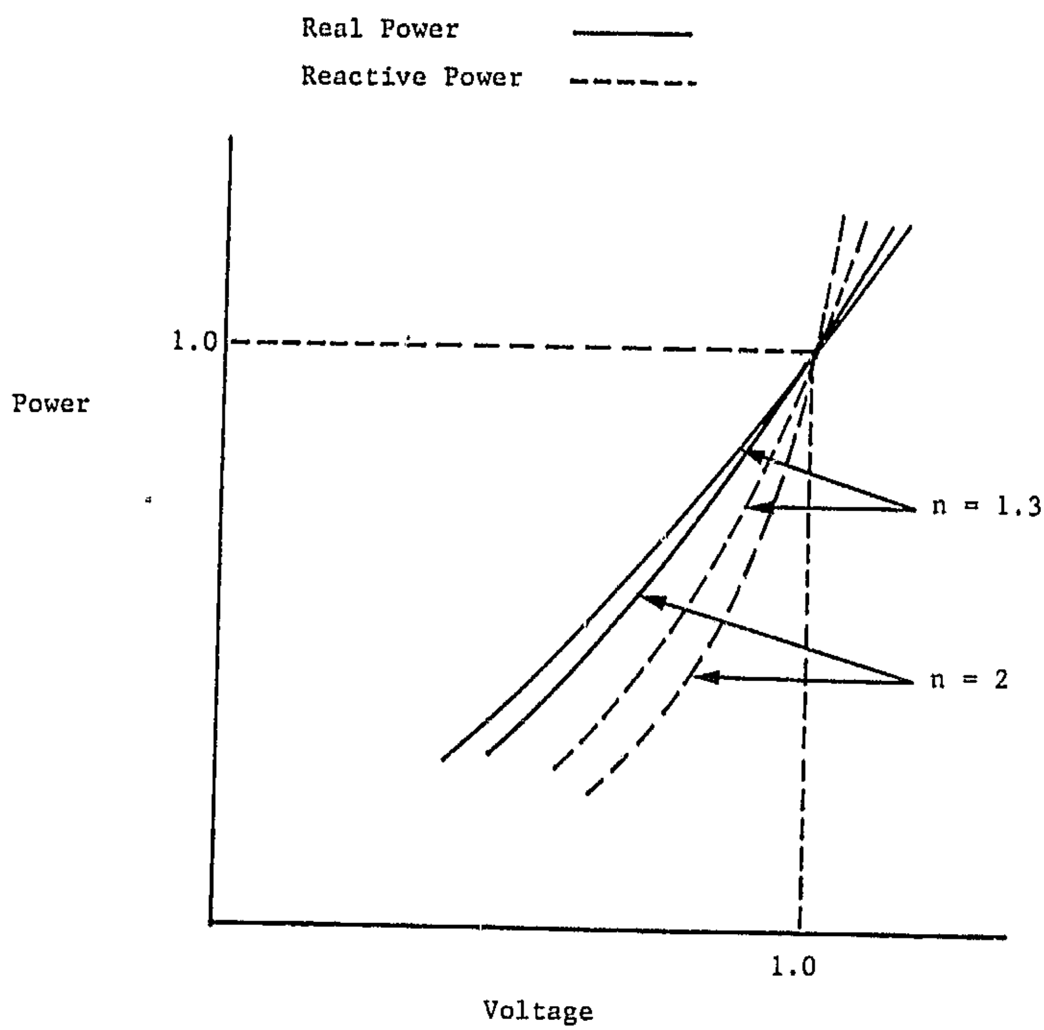


Figure 2-3. Real and Reactive Power as a Function of Voltage for Two Different Load Models, Normalized

Both the load models shown in Figure 2-3 have been used in this study. Both are represented by equations of the form:

$$P = K_1 V^n$$

and

$$Q = K_2 V^n$$

For constant impedance loads, of course, n = 2 and the constants K_1 and K_2 are fixed by the load resistance and reactance. The real part of current is given by

$$\begin{aligned} I_R &= P/V \\ &= K_1 V^{n-1} \\ &= K_1 V \end{aligned}$$

so that K_1 is simply the equivalent (parallel) conductance of the load. Similarly, K_2 is the equivalent susceptance of the load.

For $n \neq 2$ the equations are equally simple, but the apparent impedance is dependent on the value of n.

DSG Models

There is a large variety of DSGs that could be modelled and included in this study. Indeed, the number of different DSG types is so large that some means of reducing the size of the problem must be employed if an economical job is to be done.

Fortunately, the mathematical model need only extend as far as the power conversion device, and can be considered to be independent of the primary source of energy. Thus, for example, if a synchronous generator is modelled, its impact on system voltage, in the steady state, will be the same whether it is driven by a water turbine or by an industrial cogeneration system. Similarly, the model used for a dc-ac inverter would be the same whether it is used in a photovoltaics installation or in a battery storage. Further justification for this approach may be found in the fact that, for practical machines, the dynamics of the exciter are always faster than the dynamics of the input power and its control system.

The number of models required is therefore considerably less than the number of DSG types. Table 2-1 shows the models developed for the study, and typical applications.

TABLE 2-1.

DSG MODELS AND TYPICAL APPLICATIONS

Model	Application
Synchronous Machine	Low Head Hydro
Induction Generator	Wind Turbine
dc-ac Inverter	Photovoltaics, Fuel Cell

The synchronous machine and the inverter both have their own control systems that determine their performance. In the case of the synchronous generator connected to a power system, for example, the exciter system determines the reactive power output of the generator. Depending on what assumptions are made regarding the control system for the exciter, different models must be used to represent it.

Synchronous Generator

Synchronous generators are used in many cogeneration applications, and are also used in conjunction with water turbines. Unlike the induction machine, synchronous generators have a separate source of excitation to produce the rotating magnetic field, and they are capable of producing or consuming reactive power.

Whether a synchronous generator consumes or produces reactive power in a power system application depends upon the excitation. This in turn depends on the exciter control system.

In our present study the distribution system voltage is largely determined by the power system (this is quite typical of power system application of synchronous machines) and the DSG excitation system is controlled by a feedback system.

Three different controllers were modelled. One controller model assumes an exciter set to maintain constant voltage (assumed to be one per unit) at the terminals. This is a reasonable exciter control for a generator operating independently, and also seems to be the kind of controller called for by the interconnection agreements between some utilities and DSG operators.

A second exciter control model assumes that the exciter is attempting to maintain constant reactive power at the terminals. Unity power factor (i.e., zero reactive) was assumed in the study, but there is no reason why the same program could not be used with other reactive power values.

The third exciter model is the simplest of all. In this model the exciter current is held constant. This may be taken as representative of a synchronous machine without exciter feedback, or of a permanent magnet type machine.

The first exciter model assumes a simple static feedback type of controller in which the excitation is derived by amplifying an error signal which represents the difference between the terminal voltage and a reference voltage. Thus, if VT is the terminal voltage and VREF is the reference voltage, the excitation is given by

$$V1 = KG(VT - VREF)$$

where V1 is the voltage behind generator reactance, i.e., the excitation, and KG is a gain constant. (Note that we are using the same symbols here, without subscript, that are used in the computer programs.) In this study a gain of 10 was assumed, as this allows the terminal voltage to depart somewhat from the nominal value without causing the exciter system to reach under- and over-excitation limits, set at 0.0 and 2.5, respectively.

The second exciter model assumes a simple exciter feedback system where the feedback signal is obtained by amplifying an error signal which represents the difference between the output reactive power and a reference reactive power. By setting the reference value for reactive power to zero, this control is equivalent to power factor control with a reference power factor of unity. Unity power factor control, achieved as described above, can be represented by

$$V1 = K(Q - QREF)$$

where Q and QREF are the reactive power output and the reference reactive power, respectively. (In this study, QREF = 0.)

The permanent magnet exciter is simply represented by

$$V1 = CONSTANT$$

The constant value was chosen to produce unity power factor operation at full load at rated voltage.

The system studied is shown in Figure 2-4. The same circuit is used for the three exciter types studied.

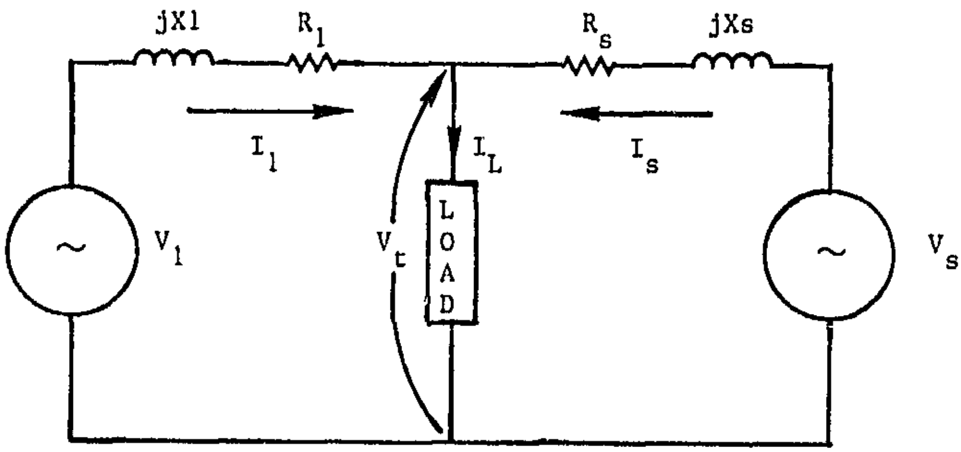


Figure 2-4. Equivalent Circuit of Distribution System with Synchronous Generator. (The same circuit is used for the three exciter types studied.)

The solution method proceeds as follows for the constant voltage type exciter.

- To simulate voltage control on the distribution system, VS is varied from 0.9 to 1.1pu.
- To simulate input power variations the value of PG, the input mechanical power, is varied from 0.02 to 0.20pu. This represents 20% penetration.
- VT is taken as reference for the calculations. The magnitude is not known at the outset, so a guess is made to provide an initial starting point. The value of VT is then determined iteratively.
  - A value is guessed for the angle between V1 and VT.
  - Using this angle the vector V1 is determined. Since the exciter is assumed to be set to control the terminal voltage and hold it constant, a knowledge of the magnitude of VT immediately gives the magnitude of V1. The angle of V1 was guessed, and is updated iteratively. At this point the magnitude of V1 is checked to see if excitation limits are exceeded, and if so, limit values are substituted.
  - Since the drop across Z1 is now fixed, I1 can be found.
  - The power delivered to the terminals can now be found, using I1 and VT.
  - The power loss in R1 is added to the delivered power to find the required input power.
  - This input power is compared to the given shaft power PM, and the process repeated iterating on the angle until a power match is obtained.
- Once the power match is obtained for the generator, the value of IS can be found.
- The volt-drop across ZS is found.
- The value of VS can be calculated.
- The magnitude of this calculated value of VS can be compared with the given value of VS and the process repeated, iterating on the initial guess of the value of VT.
- Once convergence is obtained, the required terminal parameters are calculated and printed.

Vector diagrams for the system are shown in Figures 2-5A (VS = 1.0 pu) and 2-5B (VS = 0.9 pu).

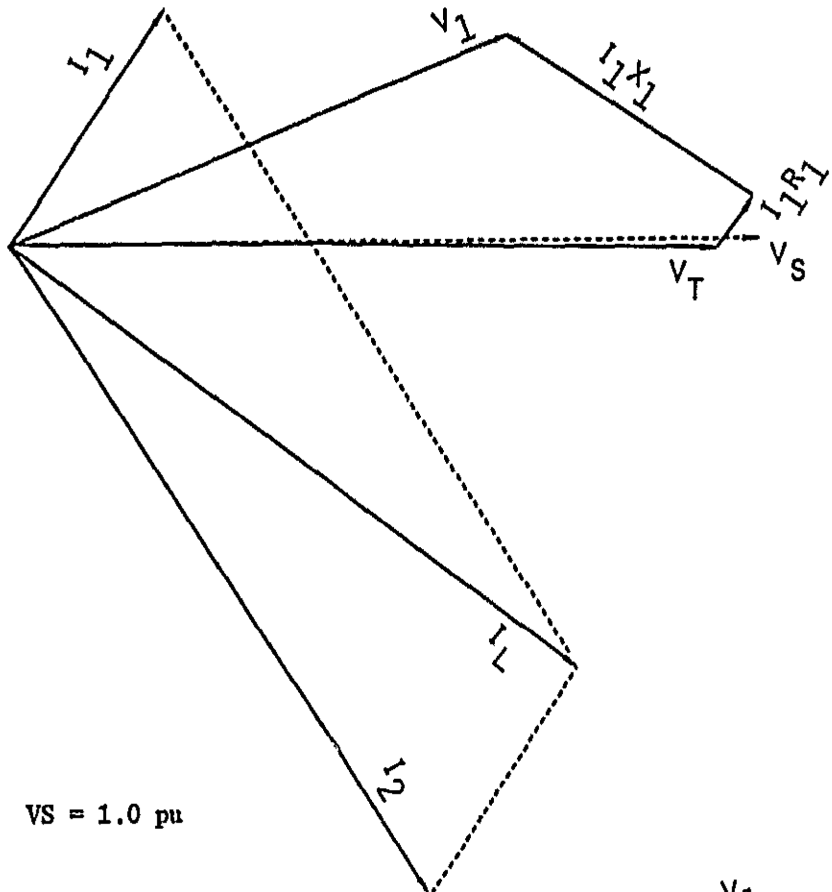


Figure 2-5A VS = 1.0 pu

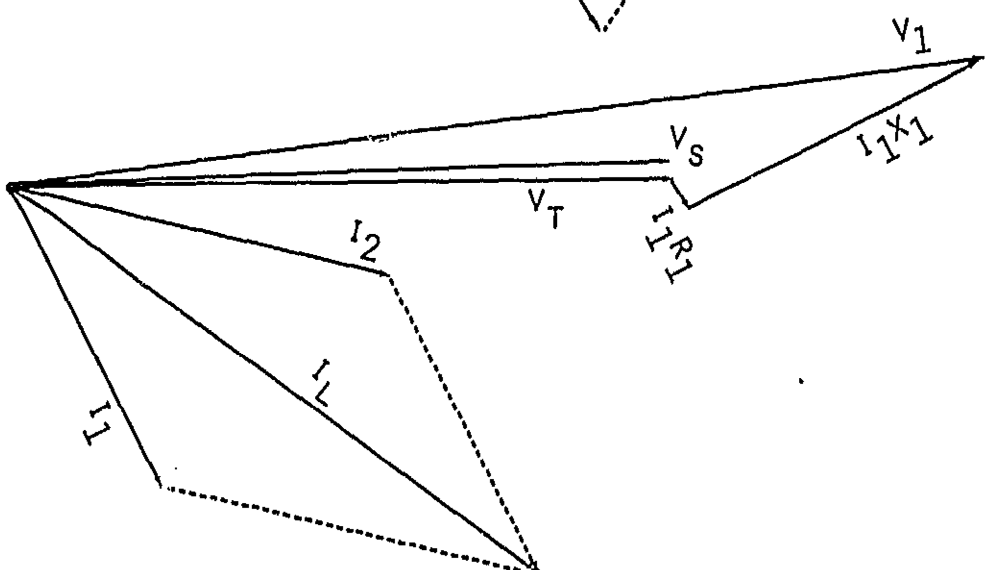


Figure 2-5B VS = 0.9 pu

Scale – Voltage, 1 cm = 0.1 pu
Current, 1 cm = 0.1 pu

Figures 2-5A and B. Vector Diagrams for Synchronous Machine with Constant Voltage Exciter and Heavy Load.

The solution method is shown in diagram form in Figure 2-6.

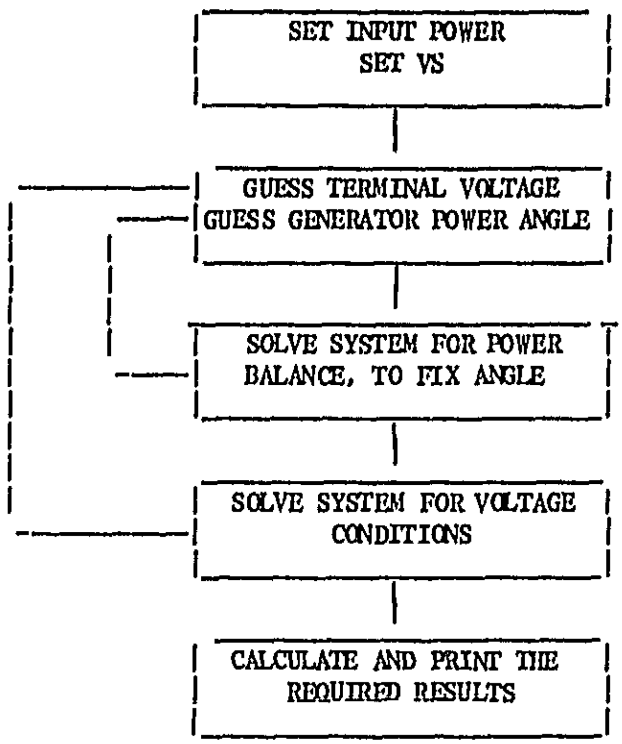


Figure 2-6. Method Used to Solve the Distribution System/Synchronous Machine Problem with the Exciter Controlled for Constant Terminal Voltage.

The solution method for the exciter controlling for constant power factor at the generator terminals is very similar. The principal difference is in the relationship between the terminal voltage and the exciter voltage.

Whereas, in the case of the constant voltage exciter, the exciter equation generates an excitation depending on a reference voltage and the measured terminal voltage, for the constant reactive controller a reference value of reactive power was used. It happens that the resulting excitation is more nearly constant than in the case of the constant voltage controller, with the result that we are able to increase the controller gain and reduce the steady state error. In this model a gain of 100 was used along with a reference value for reactive power of zero.

The third model of synchronous machine is even simpler. In this model the excitation voltage is held constant at such a value as to produce unity power factor into rated voltage at full power output from the DSG.

It may be noted that with this kind of exciter the power system is now specified in a very conventional circuit analysis kind of way, that is to say, both generators' voltage magnitude is specified along with values of all the system impedances. It might therefore be possible in principle to obtain a closed form solution for the power flows. However, it is simpler by far to modify the existing coding and continue to solve the problem iteratively. This model was implemented last and the program which solves it was derived from the previous two.

Induction Machine

An induction machine can be operated as a generator by driving it above synchronous speed, that is to say, with slip negative. Since there is no inherent means for producing excitation, the induction machine draws reactive power from the system to which it is connected. The equivalent circuit of an induction machine is similar to that of a transformer, with the transformer secondary short circuited. The rotor portion of the equivalent circuit contains a slip-dependent resistance, which accounts conveniently for the fact that the machine is either developing mechanical or electrical power.

The equivalent circuit is shown in Figure 2-7.[2-2]

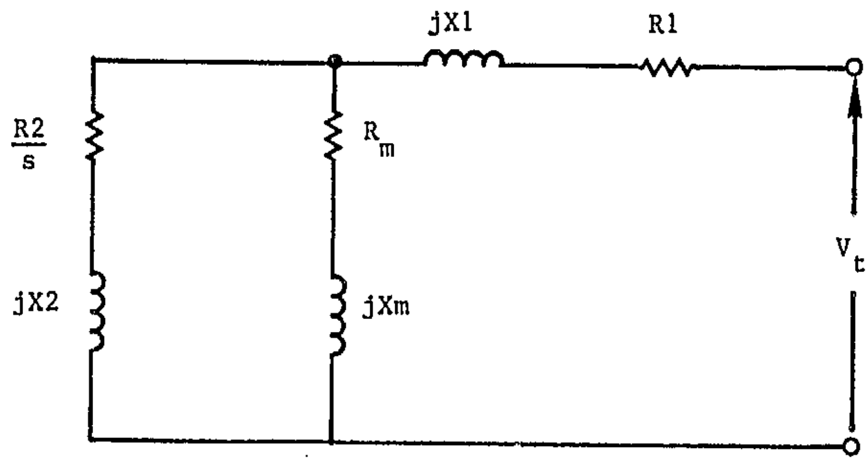


Figure 2-7. Equivalent Circuit of an Induction Machine

The equivalent circuit of Figure 2-7 will not be developed here. The circuit is quite standard, and its derivation may be found in any text on electromechanical energy conversion. Figure 2-8 shows the generator connected to the distribution system.

The solution method proceeds as follows:

- To simulate voltage control on the distribution system, VS is varied from 0.9 to 1.1pu.
- To simulate input power variations, which may be regarded as typical of DSGs, the value of PG, the input mechanical power, is varied from 0.02 to 0.20pu, representing 20% penetration.
- Since the DSG terminals are the location for measurements of parameters such as power factor, voltage, power and so on, VT is taken as a reference. Since the value is not known at the beginning of the calculation, a reasonable guess is made. This guess is updated iteratively.
    - A value of slip is guessed. This value is corrected iteratively to solve the power balance for the DSG as follows:
    - A value is found for the parallel combination of (R2/s + jX2) and (RM + jXM).
    - This value is added to (R1 + jX1).
    - The voltage VT is applied to find I1.
    - The drop across Z1 is calculated.
    - V1 is found from VT and Z1 drop.
    - IM is found by applying V1 to ZM.
    - IG is found by adding I1 and IM.
    - Input power is found by multiplying IG^2 and R2/s.
    - If this input power does not match the value of PM, the value of slip is corrected and the process repeated.
- Once the slip is found, I2 is found by subtracting I1 from IL.
- The ZS drop is found.
- VS is found by adding VT and the ZS drop. If VS does not match the value set at the outset, the value of VT is modified and the procedure repeated.
- Various required parameters are calculated and printed.

A vector diagram for the system is shown in Figure 2-9.

The procedure is shown diagrammatically in Figure 2-10.

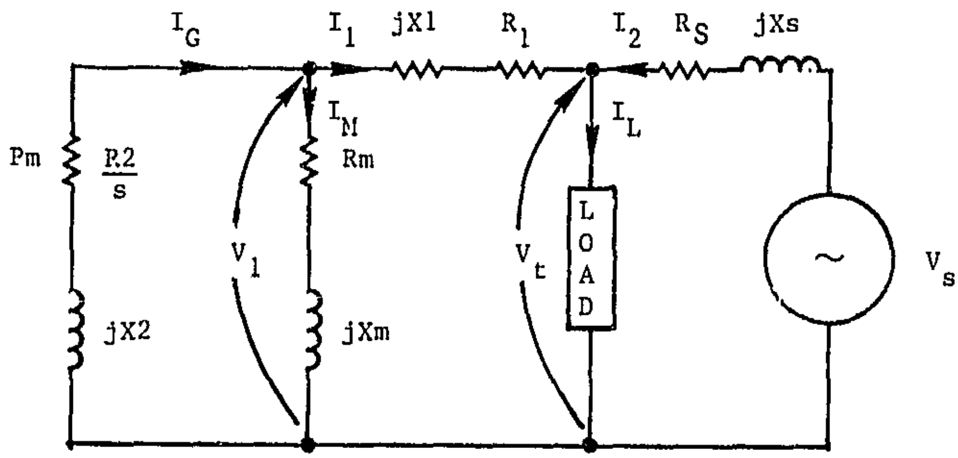
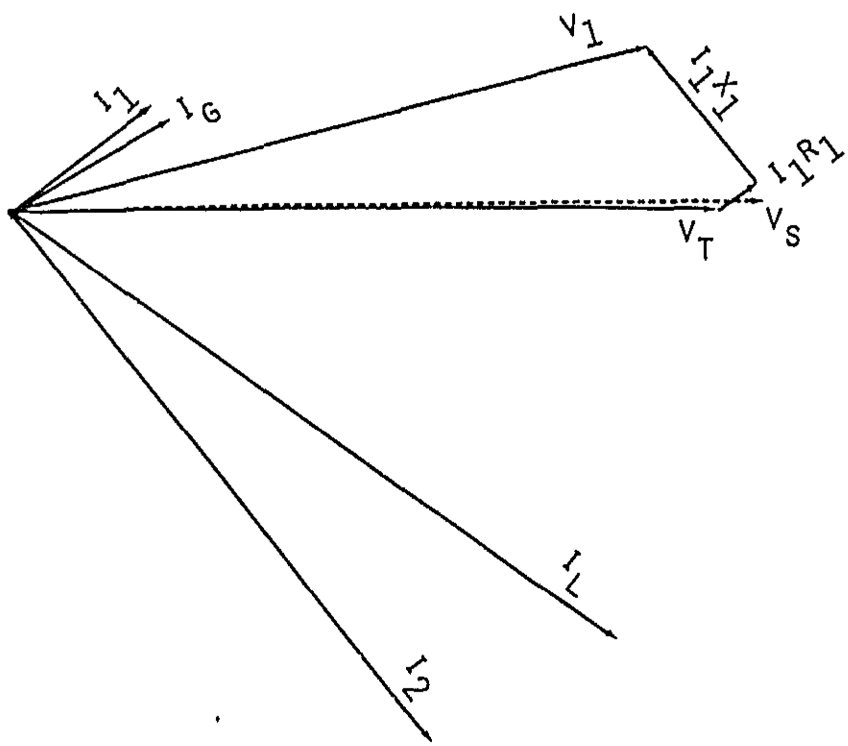


Figure 2-8. Circuit of Induction Generator Connected to Distribution System.



Scales

Voltage 1cm = 0.1 pu
Current 1cm = 0.1 pu

Figure 2-9. Vector Diagram of System with Induction Machine

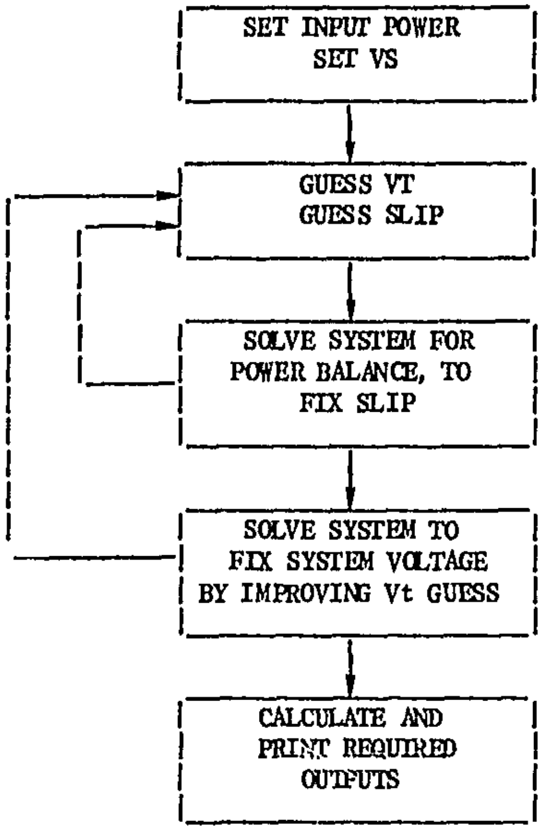


Figure 2-10. Solution Method for the Distribution System/Induction Machine Problem

Induction Machine with Capacitor Compensation

A criticism that may be levelled at the induction generator is that it consumes too much reactive power. The amount of reactive power consumed depends upon the terminal voltage and the output power, and it is not simple to give it in closed form. It is entirely possible, however, that the utility to which this kind of DSG is connected will require that the owner provide compensation for the reactive power consumed. Normally this compensation would consist of a power factor correction capacitor, sized to bring the combined power factor up to a value acceptable to the utility. Since this is a generic study, we have chosen to correct the power factor to unity when the DSG is operating at rated power into rated voltage. This corresponds to the largest power factor correction capacitor that may reasonably be required.

The computer program which calculates the results for the compensated induction machine is based on the uncompensated version. Once the current injected by the DSG into the system is calculated, a correction is applied to the imaginary component, such that at rated power into the DSG and 1 per unit terminal voltage, the imaginary component vanishes.

Inverter: Constant Extinction Angle (CEA) Control

The constant extinction angle control frequently used for line-commutated inverters may be represented in a gross sense by a power injection with reactive demand equal to about 50% of the injected power. This will correspond to an extinction angle (gamma) of 15° which would be quite normal for a line-commutated inverter. Such a representation does not allow the detailed workings of the inverter to be modelled - perhaps this is fortunate - but an excellent representation of the terminal conditions may be obtained.[2-3]

The program which solves this model assumed that the inverter is 100% efficient and the output power is stepped from .02 to .2 per unit in the same way that the input power of the various other models is stepped.

The solution method is somewhat similar to the others. It begins by assuming a terminal voltage and from it calculating an injected current. The load current is found and consequently the current required from the power system is calculated. This current is multiplied by the series drop in the power system to give a value for the power system voltage and the magnitude of this voltage is then compared with the known value of the VS. Any difference between the two is used to correct the initial guess for terminal voltage.

When sufficient accuracy has been obtained, the values required for the output are calculated and printed. Since there is only one iterative loop in this program, it tends to run faster than some of the others.

CEA Controller Compensated at Full Load

A drawback of the previous type of DSG might be that the DSG consumes 50% as much reactive power as it generates active power. The owner of such a DSG may be required to compensate the terminals of his device for this reactive consumption. The simplest way to do this is with a capacitor. To model this compensation, a capacitor value was assumed such that 100% compensation was obtained when the DSG was injecting its rated power into the power system at rated voltage.

The computer program which solves this case is based on the uncompensated CEA inverter and differs only in that once the injected current is calculated a correction factor is applied to the imaginary component of this current before the power system contribution is calculated. The remainder of the program is the same and the speed at which it operates is similarly rapid.

Photovoltaic-type Inverter

While the details of the operation of many of the inverters used with low power photovoltaic arrays are proprietary, some information regarding their external characteristics is available. A simple type of inverter in current use has external properties unlike either of the two inverters described above. In this inverter the reactive power at full load is roughly the same as the CEA inverter (say 40% of the real power) but it drops only slightly as the real power decreases (to say 30% of the rated power at zero real power).

The program which solves this case is based on the program for the CEA inverter, the difference being the way in which the generator reactive power is calculated. Execution is quite fast.

Base Case

One of the programs was modified to represent the case of no injection from the DSG. Consequently the major loop (that which incremented the injected power) was not used and a rather diminished set of calculations resulted.

Again, it would be possible to calculate the required values in this rather simple situation in closed form, but it was decided that it would be more efficient to modify an existing program to solve the problem iteratively. Indeed, in view of the small size of the printout and the speed with which convergence can be obtained, this choice is clearly justified.

The principal use of the base case program is in finding the volt drop under various load conditions and with various values of system impedance.

SECTION THREE

PRESENTATION AND DISCUSSION OF RESULTS

Results

The results of the various computer programs are presented in Appendix B, Tables B-I to B-XIV, organized as follows:

Tables B-I and B-II	Synchronous machine Constant voltage exciter Light and heavy load
Tables B-III and B-IV	Synchronous machine Constant reactive control Light and heavy load
Tables B-V and B-VI	Synchronous machine Constant excitation Light and heavy load
Tables B-VII and B-VIII	Induction machine Light and heavy load
Tables B-IX and B-X	Induction machine Power factor corrected Light and heavy load
Tables B-XI and B-XII	Inverter CEA control Light and heavy load
Tables B-XIII and B-XIV	Inverter CEA — compensated at full output Light and heavy load
Tables B-XV and B-XVI	Inverter PV type — uncompensated Light and heavy load

It may be noted that the case of the dc/ac inverter with unity power factor control was not explicitly modelled. Since the controller in this case causes the inverter to look like a synchronous generator with unity power factor control, the results of that case (Tables B-III and B-IV) can be used. The synchronous machine on constant power factor control did not subject the exciter to any unusual conditions.

In the remainder of this section, the results of the computer programs are presented graphically. In all the graphs, the quantities are in per unit (system base). The terms 'heavy' and 'light' refer to loads of 0.8 + j0.6 pu and 0.08 + j0.06 pu respectively, and the parameter P is the DSG input power.

Synchronous Machine: Constant Voltage

The synchronous machine with constant voltage exciter is, at first sight, a very reasonable sort of DSG. Indeed, there is at least one utility/qualifying facility agreement in existence which requires small power producers to implement precisely this sort of control.

Since some DSG types use energy whose moment-to-moment availability is uncertain. voltage flicker might be thought of as a possible problem area. However, it may be expected that with a constant voltage controller on the exciter, variations of input power would not cause voltage fluctuations, and this is in fact the case. Figure 3-1 shows the variation of load voltage with DSG input power for the two values of load. It can be clearly seen that load voltage is independent of input power.

There is a price to pay for this kind of control. Figure 3-2 shows the reactive consumption or generation of the machine as a function of the system voltage. Since the generator is attempting to hold its terminal voltage constant, and yet the power system is actually dominant in setting the voltage, the DSG reactive reaches unreasonably large values for moderate excursions of system voltage.

The actual magnitude of the reactive demand will be limited by the machine rating and by the exciter rating. Since the model used in the computer program is only a generic representation, no details of machine or exciter ratings are available. However, in order to hold the exciter current down, the controller gain was set low (KG = 10). It might be expected that this could result in a somewhat 'soft' voltage control, and this is indeed the case.

Figure 3-3 shows the variation of load voltage with system voltage for two values of load and two input powers. The DSG exciter controller does improve the system regulation. A change in system voltage of 10% results in a load voltage change of about 6.4%

This improvement in regulation, of course, is the result of changes in DSG excitation. The excitation is shown in Figure 3-4 as a function of system voltage.

It can be seen that the excitation decreases to quite low values for values of system voltage above one per unit. However, since the maximum power that can be extracted from a machine is dependent on the magnitude of the excitation, the power transfer capability of the machine is restricted for values of system voltage above one per unit. In the case of a lossless machine, the maximum power is given by

$$P_{MAX} = \frac{V_T \cdot V_{EXC}}{X}$$

In the model used in the computer program, the effect of machine resistance was included, so the maximum power value is not so simple to calculate. During the running of the program, it was noticed that the machine's power angle (delta) was reaching quite large values as the system voltage increased, and stable solutions to the generator equations could not be reached for values of system voltage above 1.02 pu with the power system lightly loaded and the DSG input power at 0.2 pu.

The efficiency of the machine suffers because of the large reactive flow. While efficiency was not calculated explicitly, the effect can be seen in Figure 3-5, which shows the DSG output power as a function of system voltage .

Figure 3-5 shows that the machine power output falls considerably for system voltages above one per unit, and results in the machine motoring when the input power is only 0.02 pu. This may be desirable from the power system point of view, but it would probably be difficult to persuade the owner of a DSG to pay an energy bill for the privilege of improving system voltage regulation!

Because of the reactive flow, the DSG power factor is poor most of the time, being near unity only for a very small range of system voltage. This is shown in Figure 3-6. In Figure 3-6 the ordinate is labelled 'P and Q same sign' and 'P and Q opposite sign'. This allows the graph to avoid discontinuities as the machine goes from lagging to leading power factor or from generating to motoring. The same approach has been used for all power factor diagrams.

In spite of the fact that the DSG power factor is poor, the system power factor is also poor, as shown in Figure 3-7. This somewhat paradoxical result arises because of the fact that the system voltage and the DSG voltage are essentially 'fighting' one another. When the system voltage rises, for example, and the DSG reactive consumption increases, this reactive has to be generated by the system, as shown in Figure 3-8. The effect is particularly noticeable at light load because the power is so small.

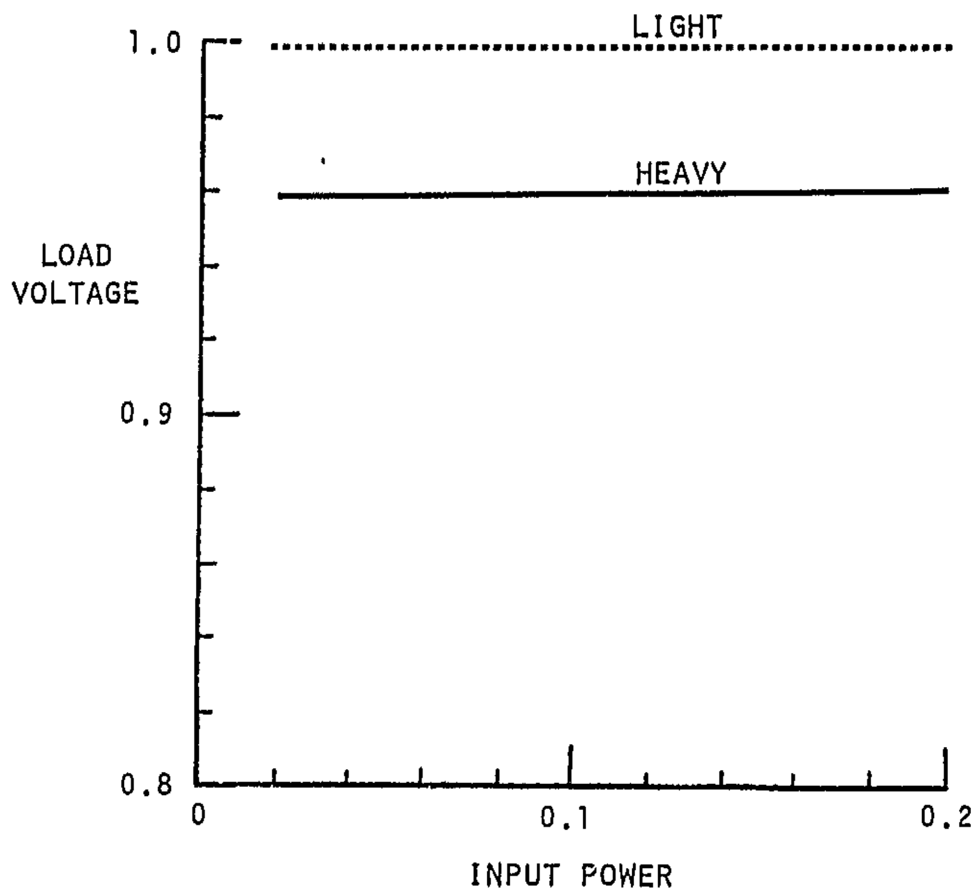


Figure 3-1. Load Voltage as a Function of Input Power, VS = 1 Synchronous Machine with Constant Voltage Exciter

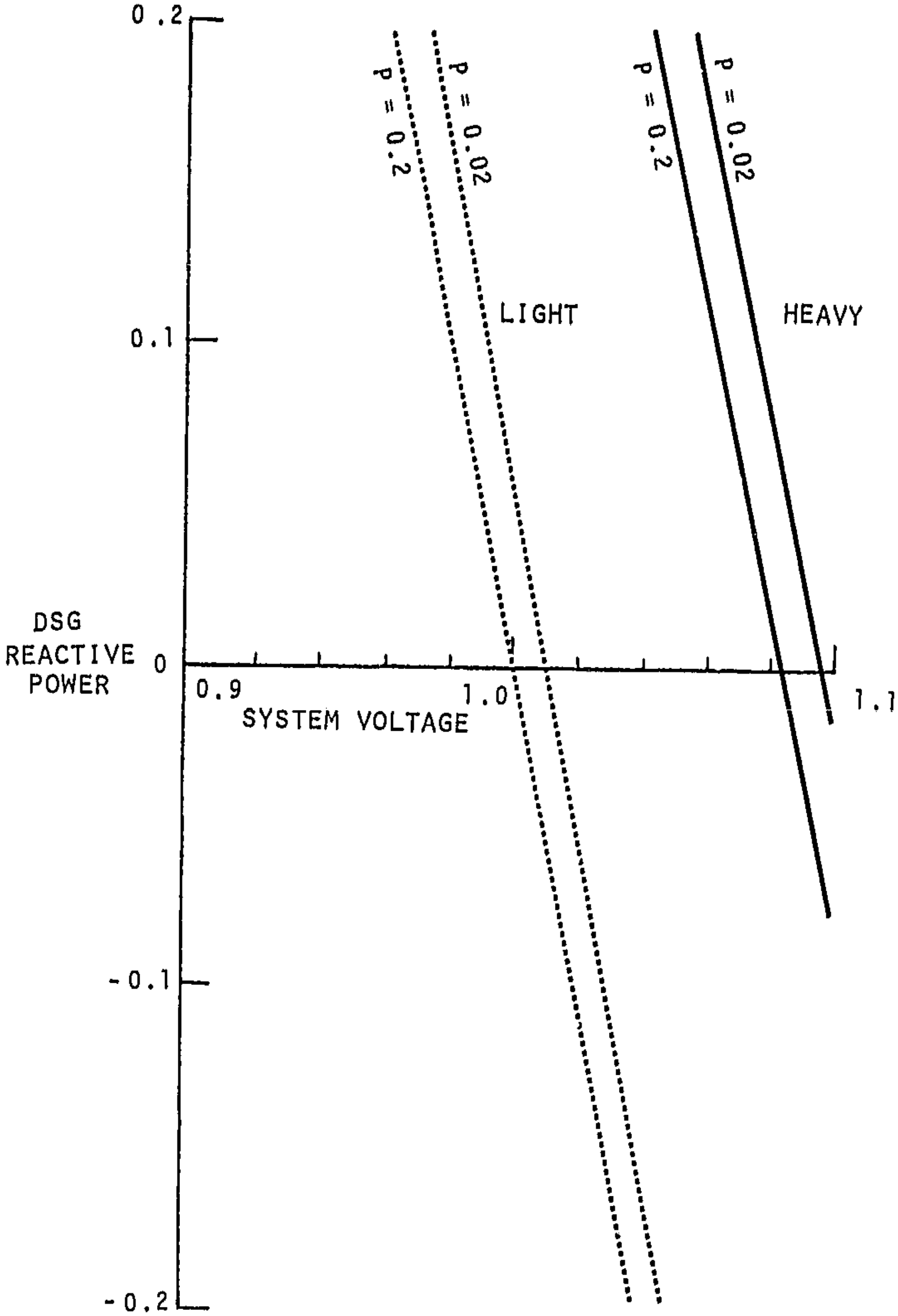


Figure 3-2. DSG Reactive Output as a Function of System Voltage, Synchronous Machine with Constant Voltage Exciter

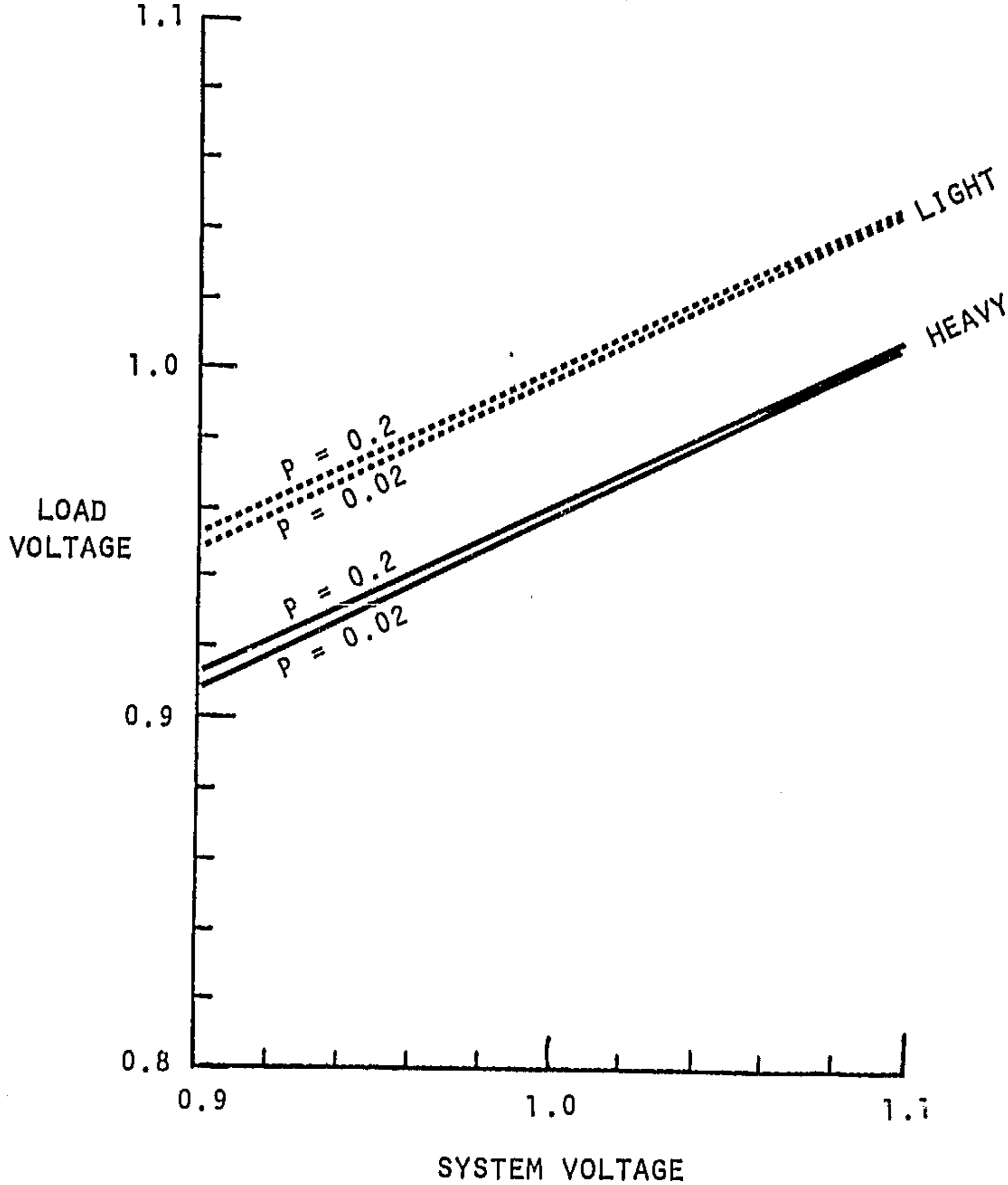


Figure 3-3. Load Voltage as a Function of System Voltage, Synchronous Machine with Constant Voltage Exciter

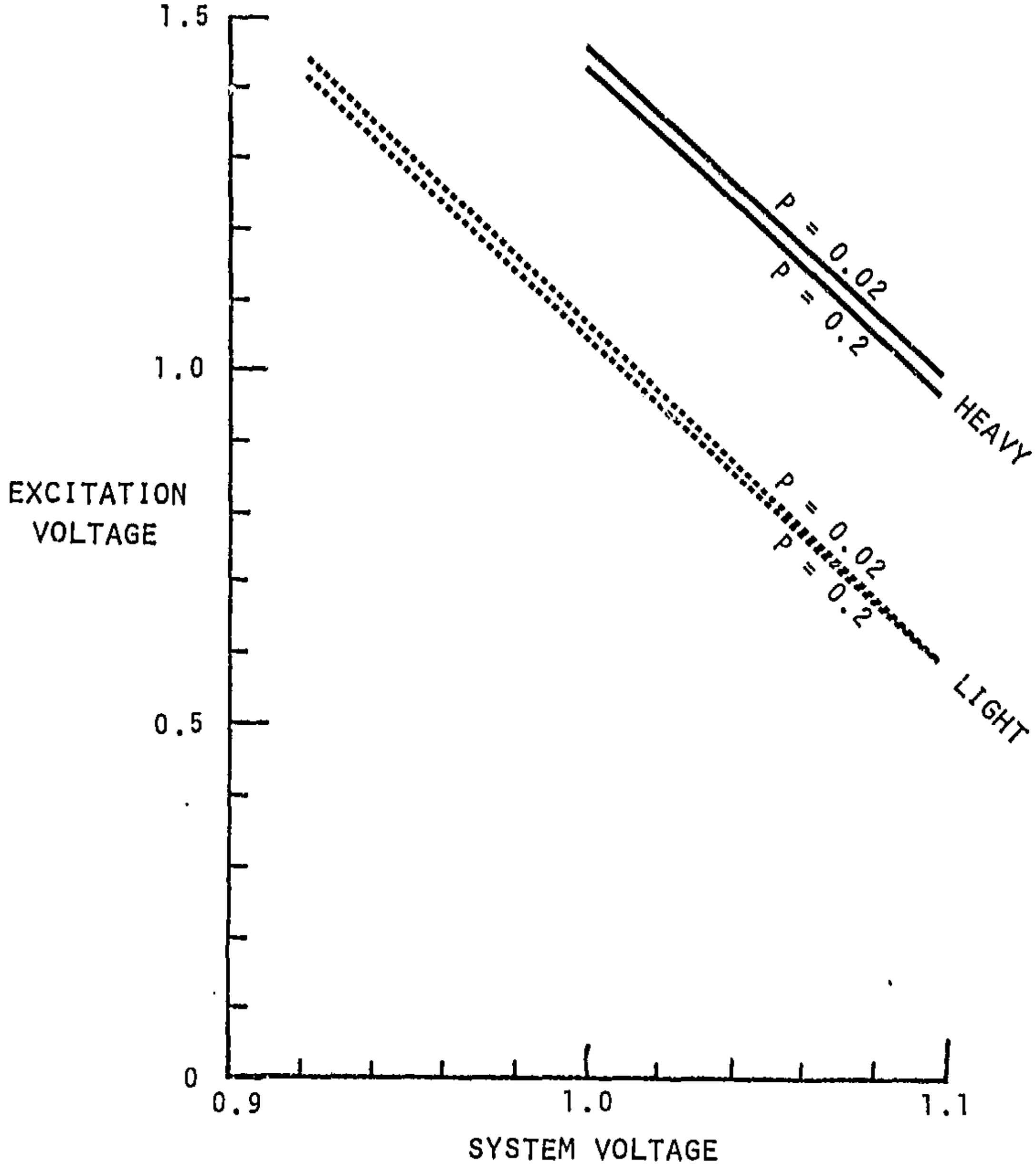


Figure 3-4. Excitation as a Function of System Voltage, Synchronous Machine with Constant Voltage Exciter

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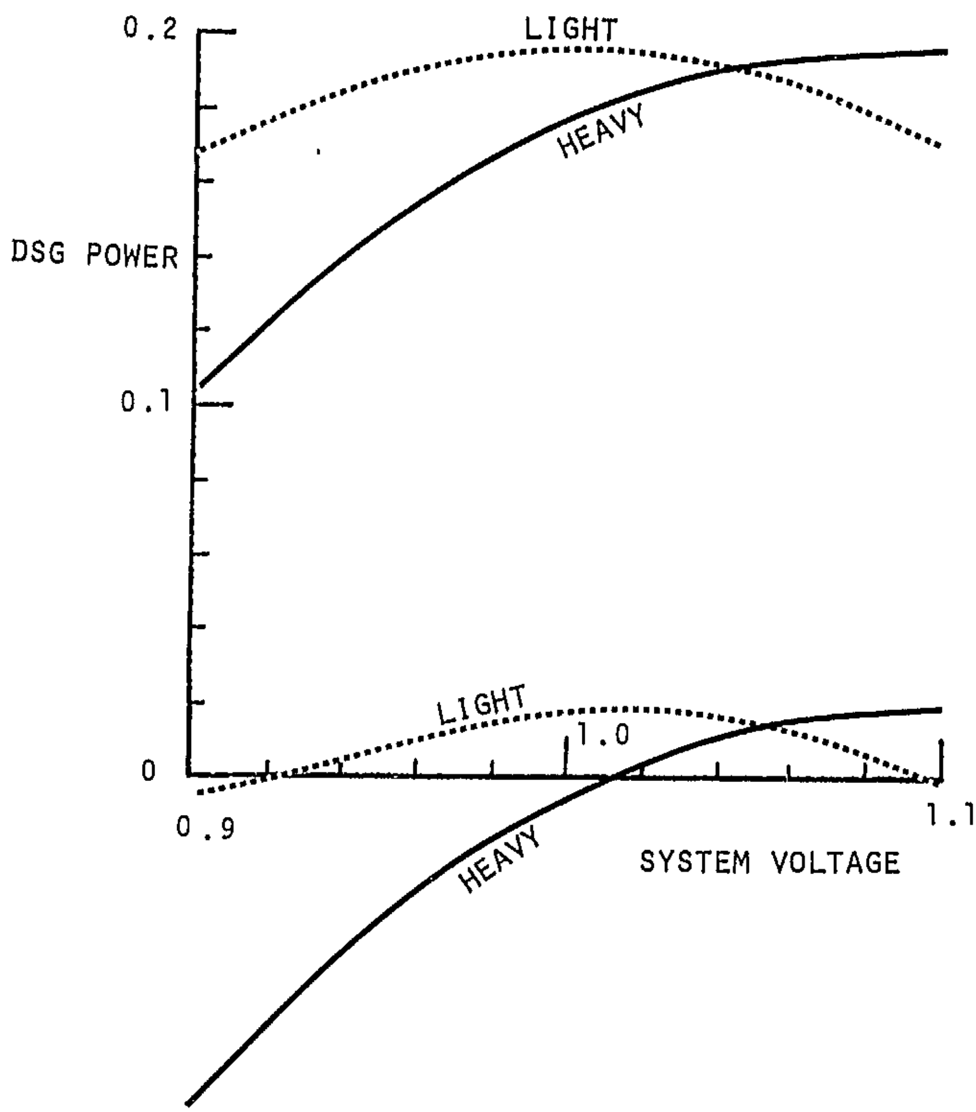

Figure 3-5. DSG Output Power as a Function of System Voltage, Synchronous Machine with Constant Voltage Exciter

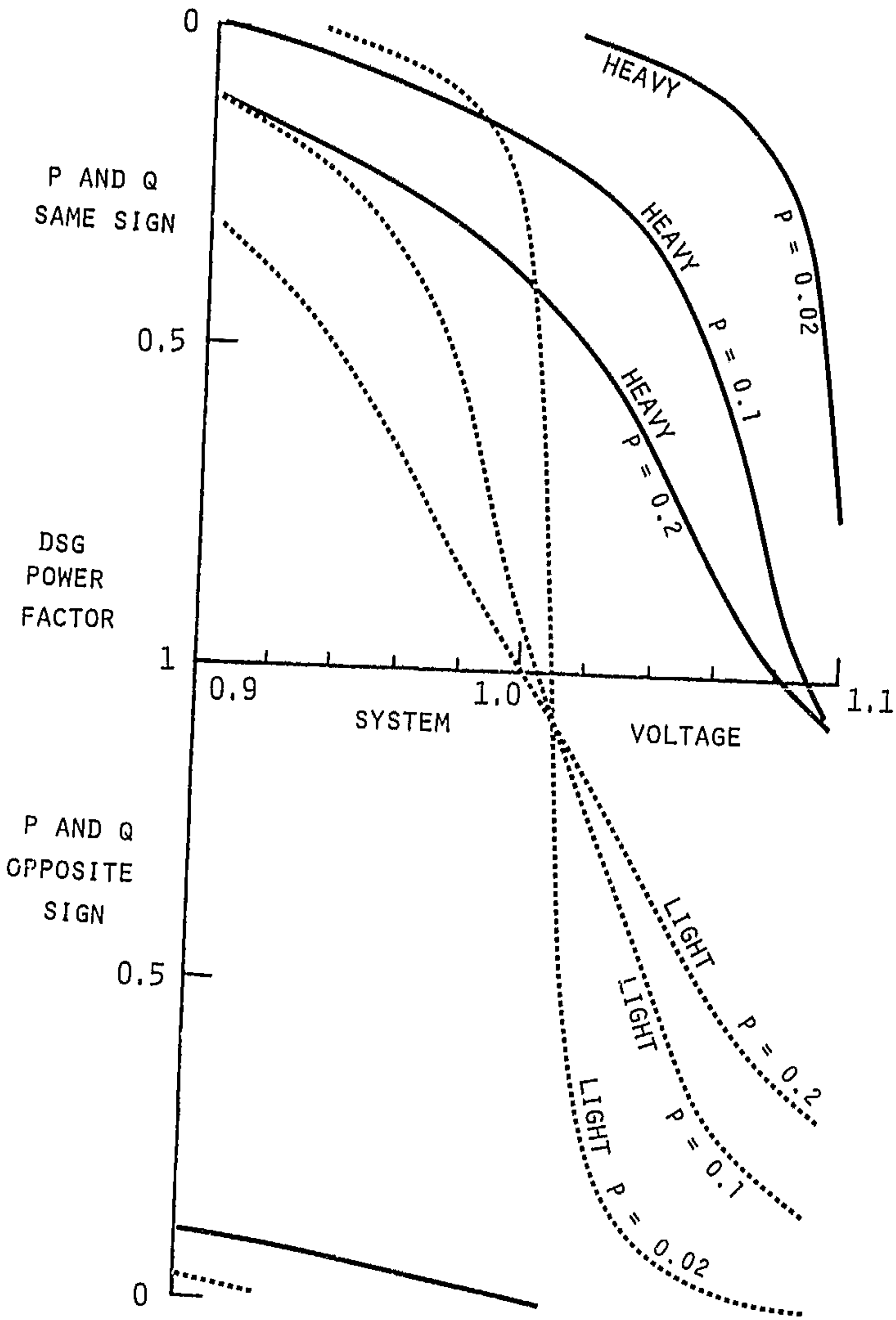

Figure 3-6. DSG Power Factor as a Function of System Voltage, Synchronous Machine with Constant Voltage Exciter

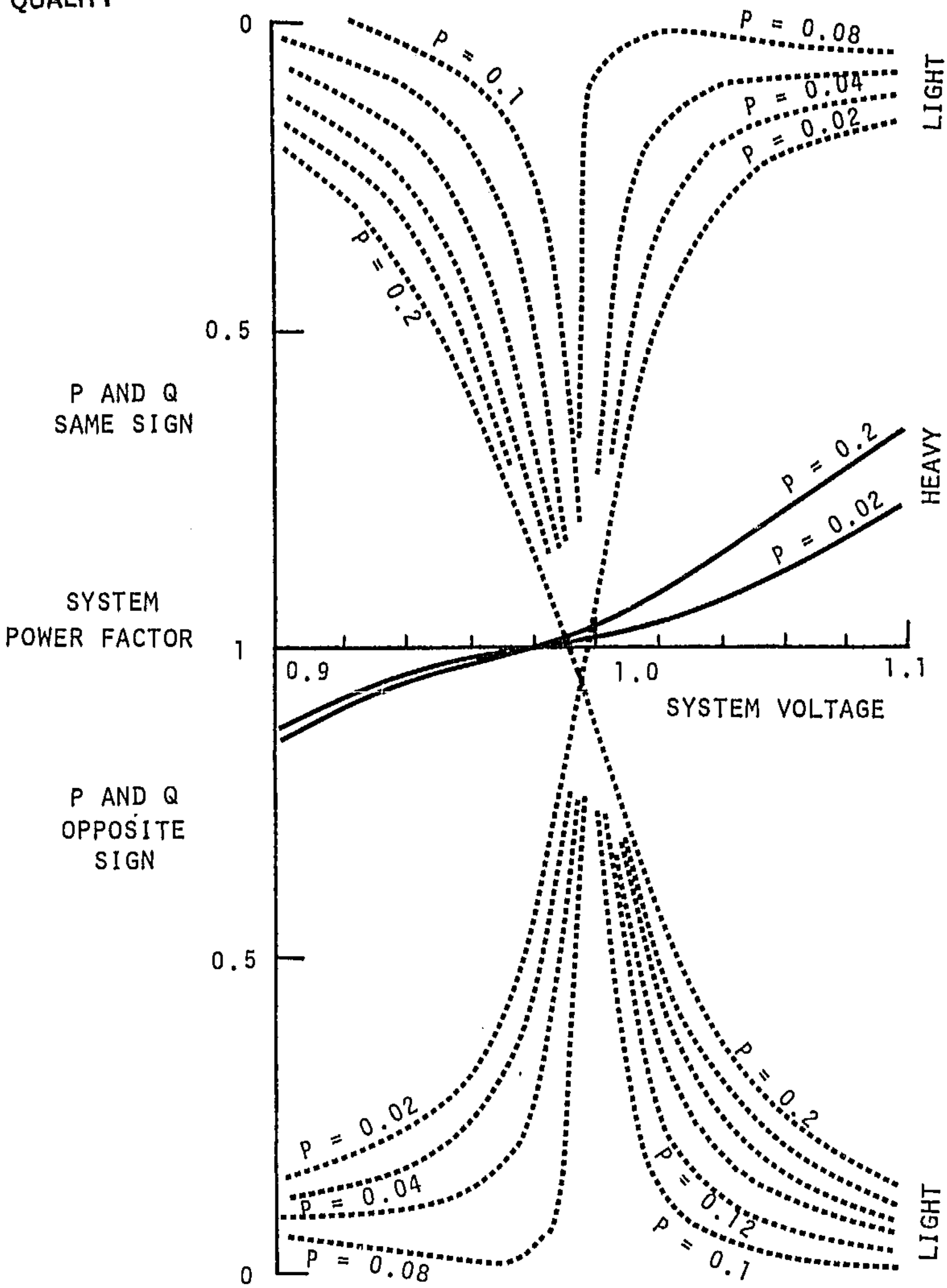

Figure 3-7. System Power Factor as a Function of System Voltage, Synchronous Machine with Constant Voltage Exciter

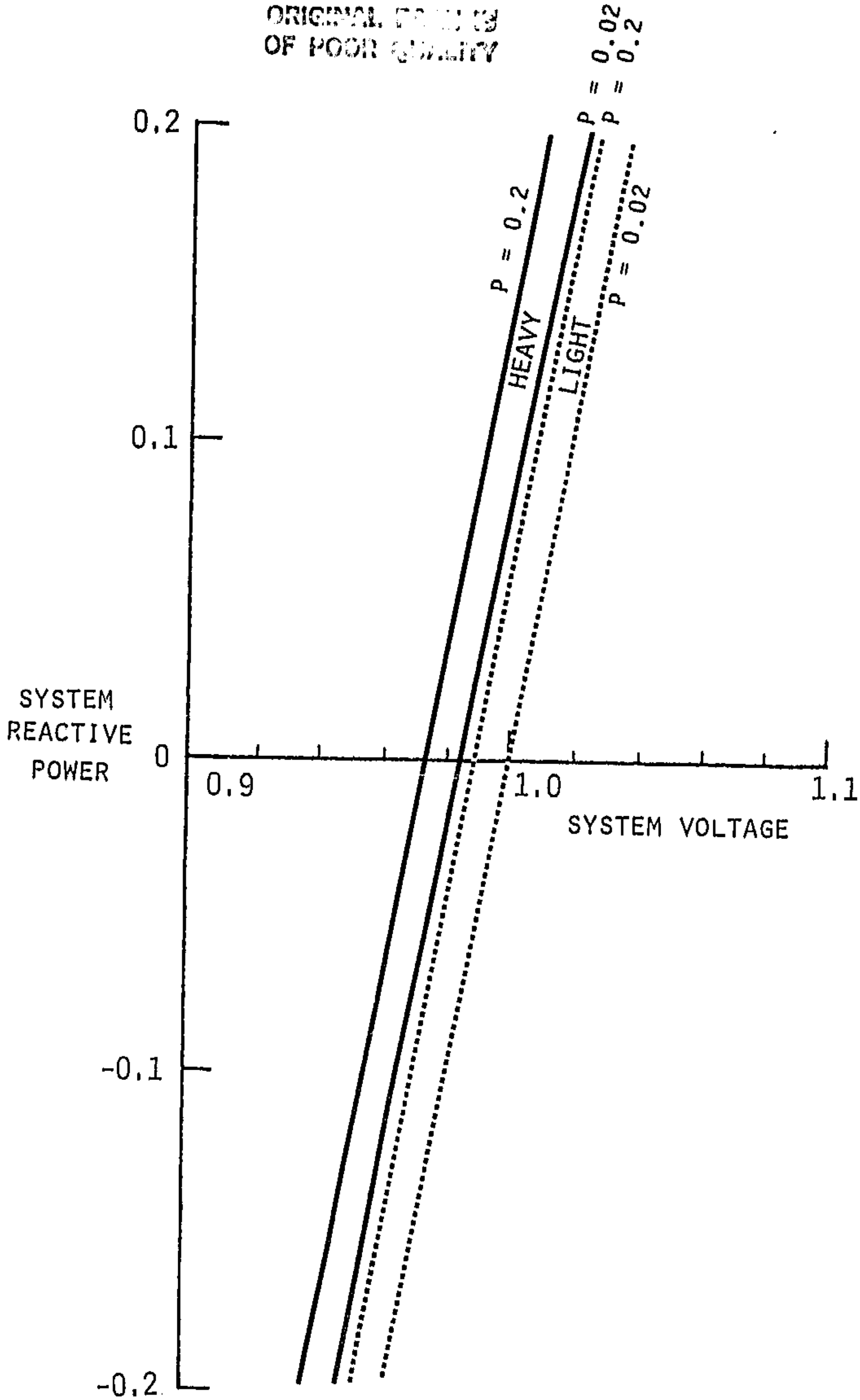

Figure 3-8. System Reactive Power as a Function of System Voltage, Synchronous Machine with Constant Voltage Exciter

Synchronous Machine: Constant Reactive

The constant-voltage exciter resulted in an output voltage which was sensibly independent of the power output. It may be thought that the constant reactive controller would not give such good results in this regard. Figure 3-9 shows the load voltage as a function of input power for the constant reactive (unity power factor) generator. It can be seen that the load voltage is still fairly independent of the DSG input power. The load voltage is also somewhat lower than in the constant-voltage case.

The constant reactive synchronous machine model was originally written as a model of the dc/ac inverter with unity power factor control. In order to be used to represent a synchronous machine, it was necessary only to verify that the exciter would not be over-stressed. Figure 3-10 shows the exciter voltage as a function of system voltage.

The excitation can be seen to be almost constant, increasing only slightly as the system voltage increases. The model can therefore be used for the synchronous machine as well as the dc/ac inverter. Since the results are presented here, they are not repeated under the heading 'ac/dc inverter'.

Load voltage with this kind of controller is somewhat more dependent on the system voltage than in the case of the constant-voltage exciter. This is shown in Figure 3-11.

As shown in Figure 3-11, a 10% change in system voltage results in about a 10% change in load voltage. Voltage regulation is therefore no worse than it would be without the DSG.

DSG power factor and system power factor are shown as functions of system voltage in Figures 3-12 and 3-13.

The DSG power factor is, of course, uniformly good (even though a constant (zero) Q controller was used in the computer model rather than a constant (unity) power factor controller). The DSG power factor scarcely went below 0.88 and was above 0.96 for all except the lowest value of DSG input power.

System power factor, on the other hand, becomes quite poor - reaching zero when the DSG input power exactly matches the load. Under these conditions, the system is supplying only reactive power.

The efficiency of the DSG is uniformly good, because of the good power factor. This is evident from the curves of DSG power against system voltage, shown in Figure 3-14.

There is little point in showing the DSG or system reactive power for the synchronous machine with this kind of controller. The DSG reactive consumption is, as the name implies, approximately constant and the load reactive power determines the system reactive output.

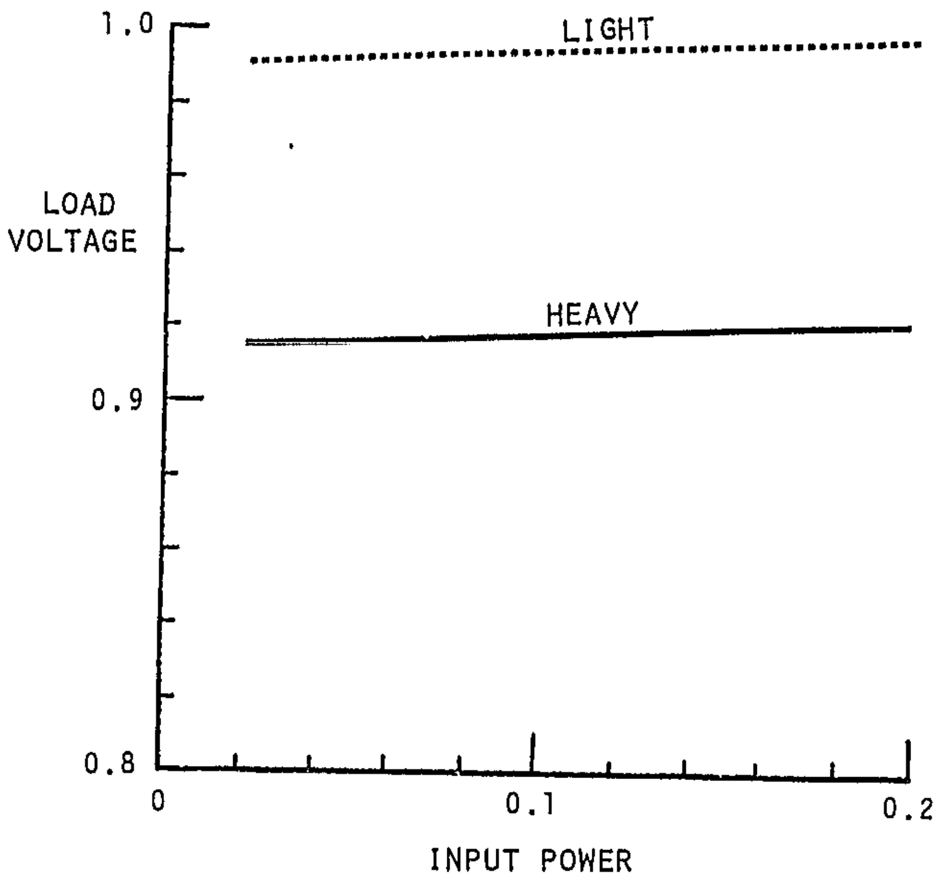

Figure 3-9. Load Voltage as a Function of Input Power, VS = 1
Synchronous Machine with Constant Reactive Exciter

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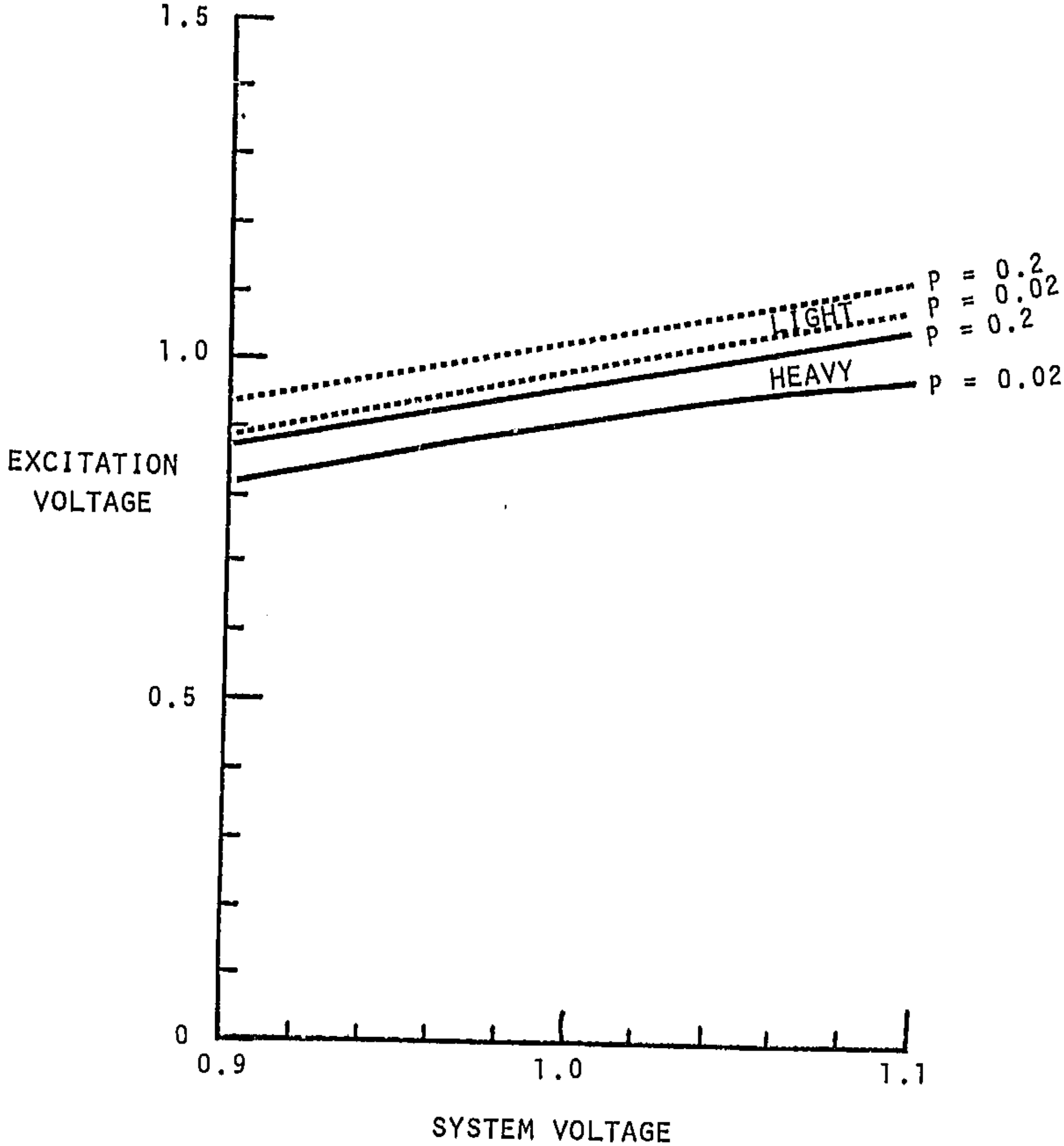

Figure 3-10. Excitation as a Function of System Voltage, Synchronous Machine with Constant Reactive Exciter

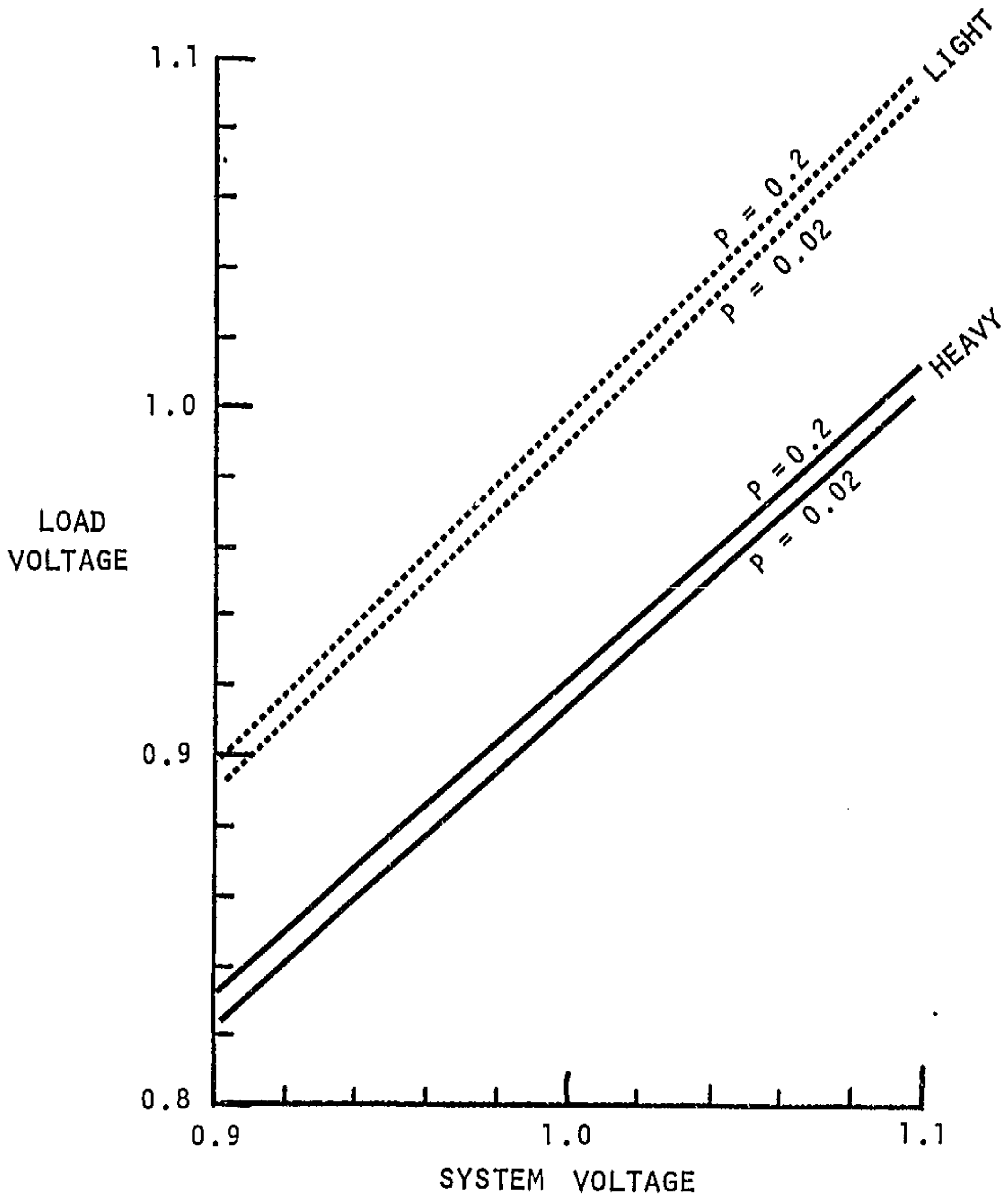

Figure 3-11. Load Voltage as a Function of System Voltage, Synchronous Machine with Constant Reactive Exciter

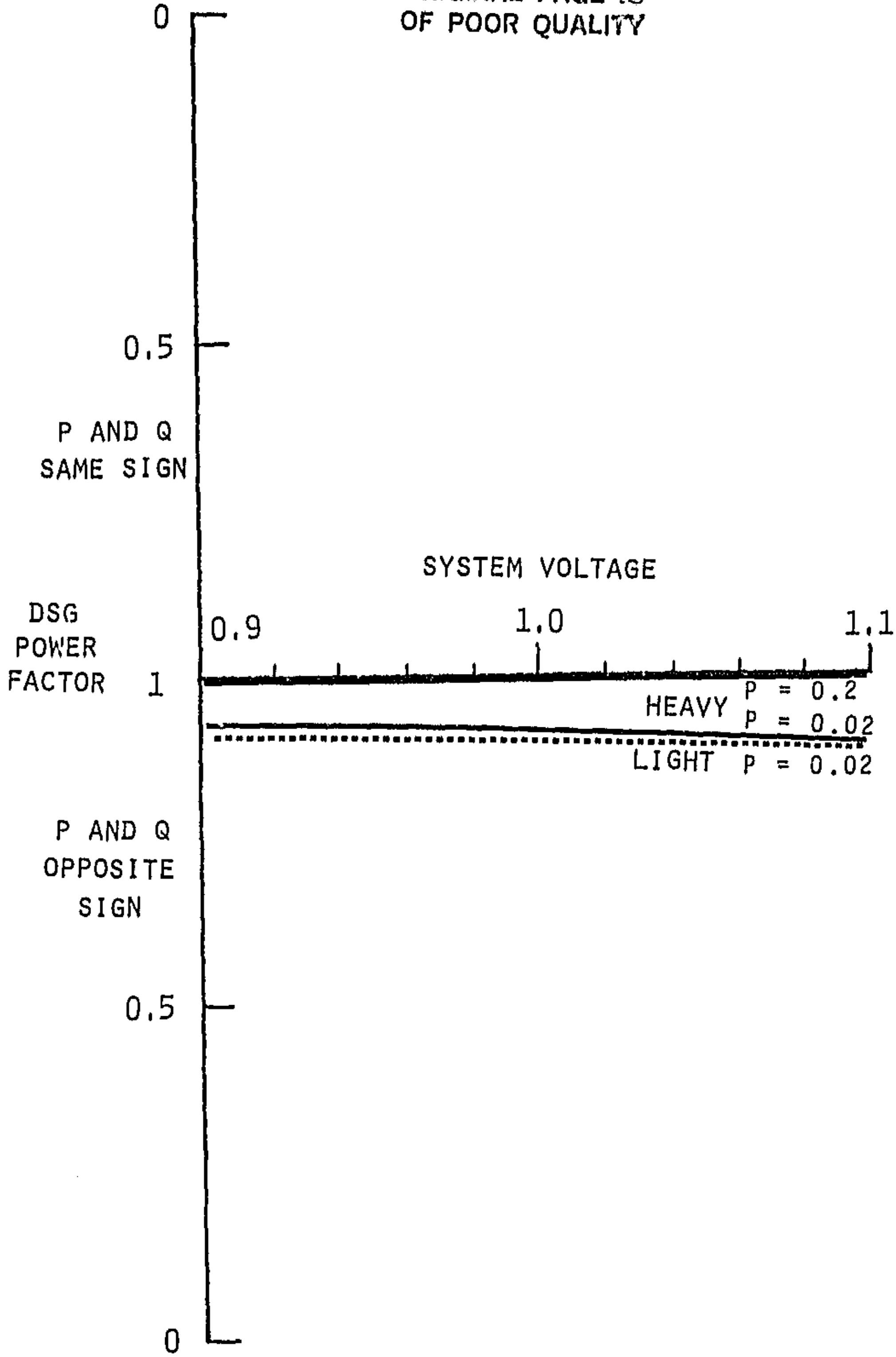

Figure 3-12. DSG Power Factor as a Function of System Voltage, Synchronous Machine with Constant Reactive Exciter

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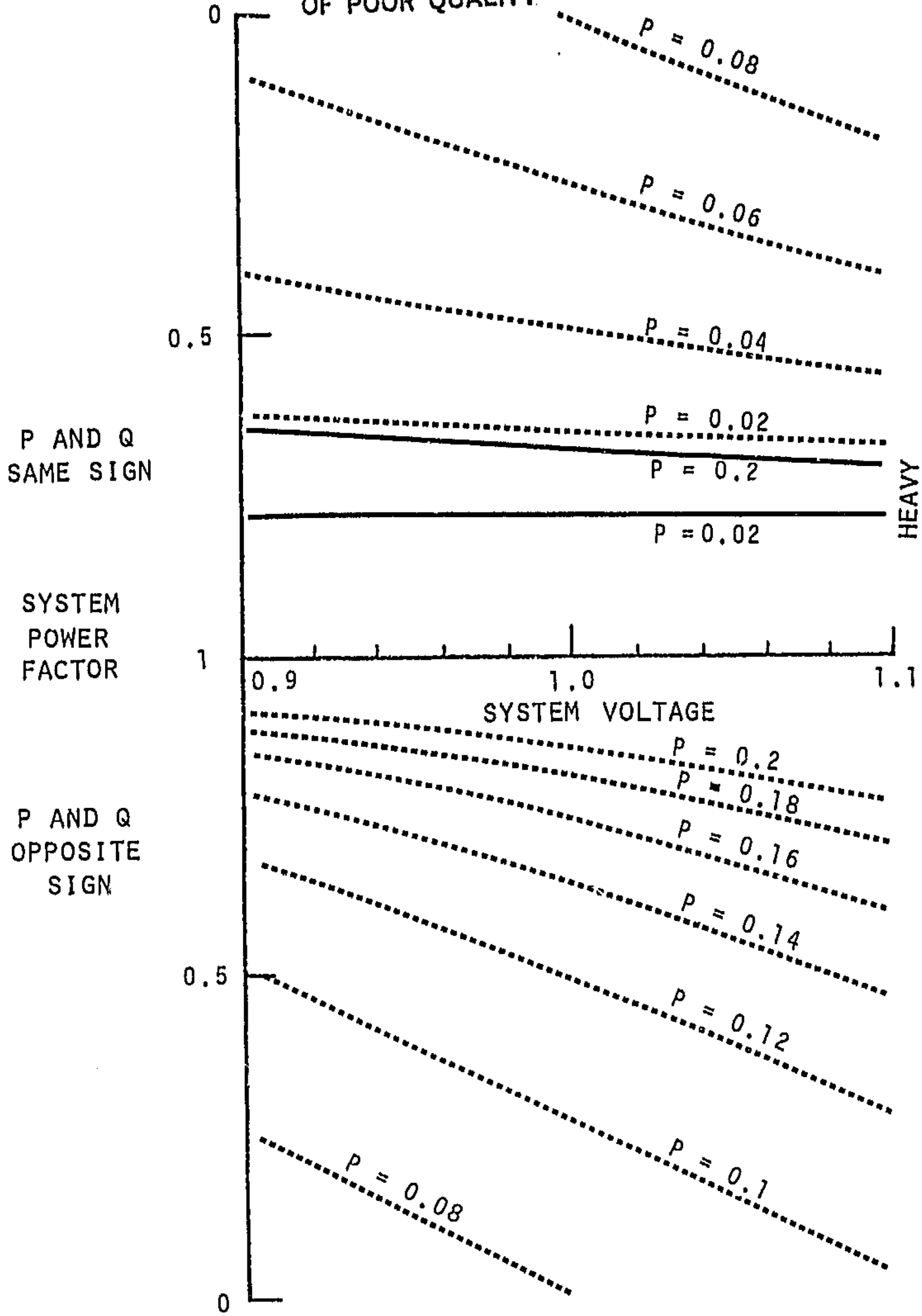

Figure 3-13. System Power Factor as a Function of System Voltage, Synchronous Machine with Constant Reactive Exciter

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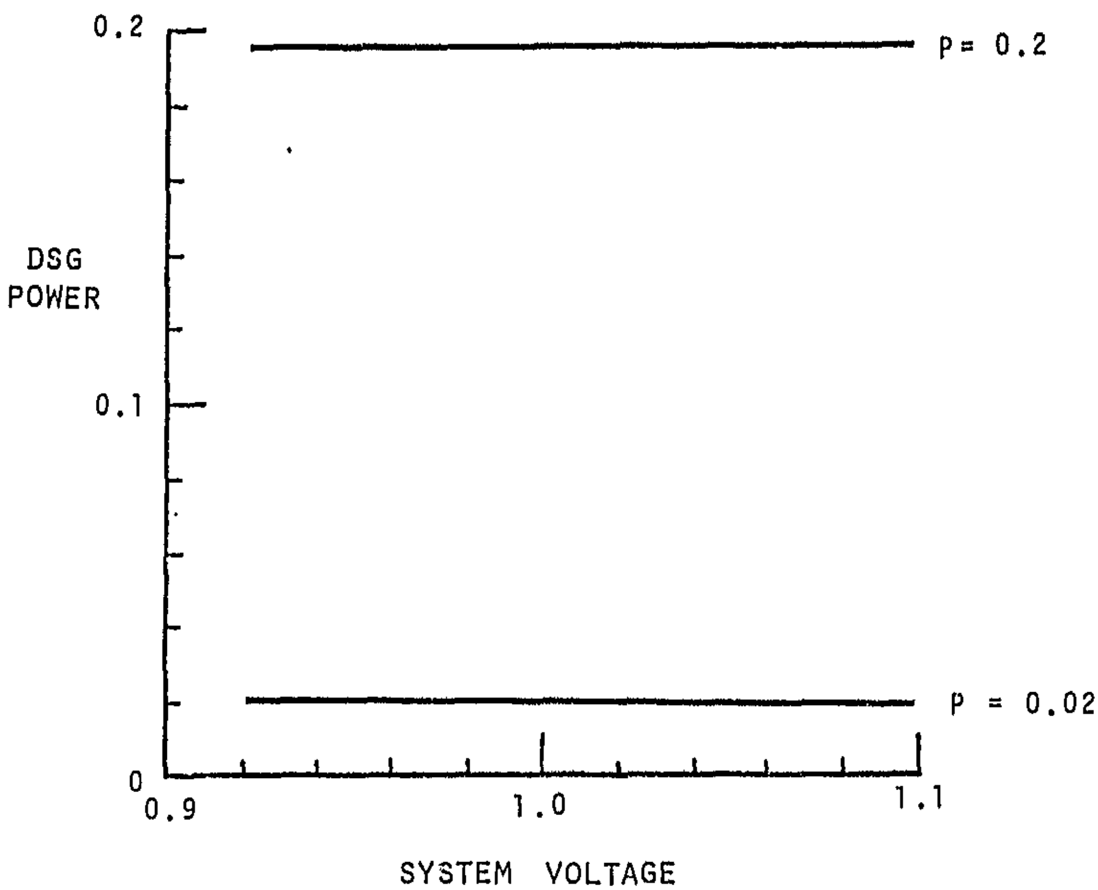

Figure 3-14. DSG Power as a Function of System Voltage, Synchronous Machine with Constant Reactive Exciter

Synchronous Machine: Constant Excitation

Since the excitation for the constant reactive generator is more nearly constant than in the case of the constant voltage controller, it was thought worthwhile to examine the effect on the system of a generator with constant excitation. This might also be taken as representative of a permanent magnet type generator. Once again, the series of graphs begins with a curve of the load voltage against the input power, as shown in Figure 3-15. It can be seen that the load voltage is still fairly independent of the DSG input power.

The load voltage varies with the system voltage in a manner very much akin to the constant reactive generator. This is shown in Figure 3-16.

The DSG power factor is shown in Figure 3-17. It can be seen that the power factor is quite reasonable for values of machine power about 0.1, or 50% of the rating of the machine. For lower values of output power, the power factor becomes quite poor, especially under heavy load where the voltage on the system has gone down. This is not surprising since the excitation for this machine was fixed so that it would deliver rated output at unity power factor into rated voltage.

Figure 3-18 shows the system power factor as a function of system voltage. At heavy load the power factor is quite good, being largely determined by the load on the systems, but at light load, as the voltage changes, the system power factor goes through some quite violent excursions. This is because the system power is quite small and the DSG can be absorbing or generating reactive power, depending on the relationship between its excitation and the system voltage.

Figure 3-19 shows the DSG power as a function of system voltage. It can be seen in this figure that the effect of the wide variations in DSG power factor is some slight inefficiency as the system voltage drops below 1 per unit, the effect being more pronounced for heavy load. The inefficiencies are. however. very much smaller than the inefficiencies in the case of the constant voltage controller. This is perhaps surprising in view of the extreme simplicity of this control system. It should be borne in mind that the DSG models are otherwise identical.

Figure 3-20 shows the variation of DSG reactive as a function of system voltage. As expected, the reactive output of the machine is positive for low values of system voltage, because here the machine is effectively over-excited, and negative for high values of system voltage because it is effectively under-excited. In this respect it is somewhat similar to the constant voltage exciter, but the variation in DSG reactive is much smaller than in that case.

As a result the system reactive varies somewhat less, as is shown in Figure 3-21.

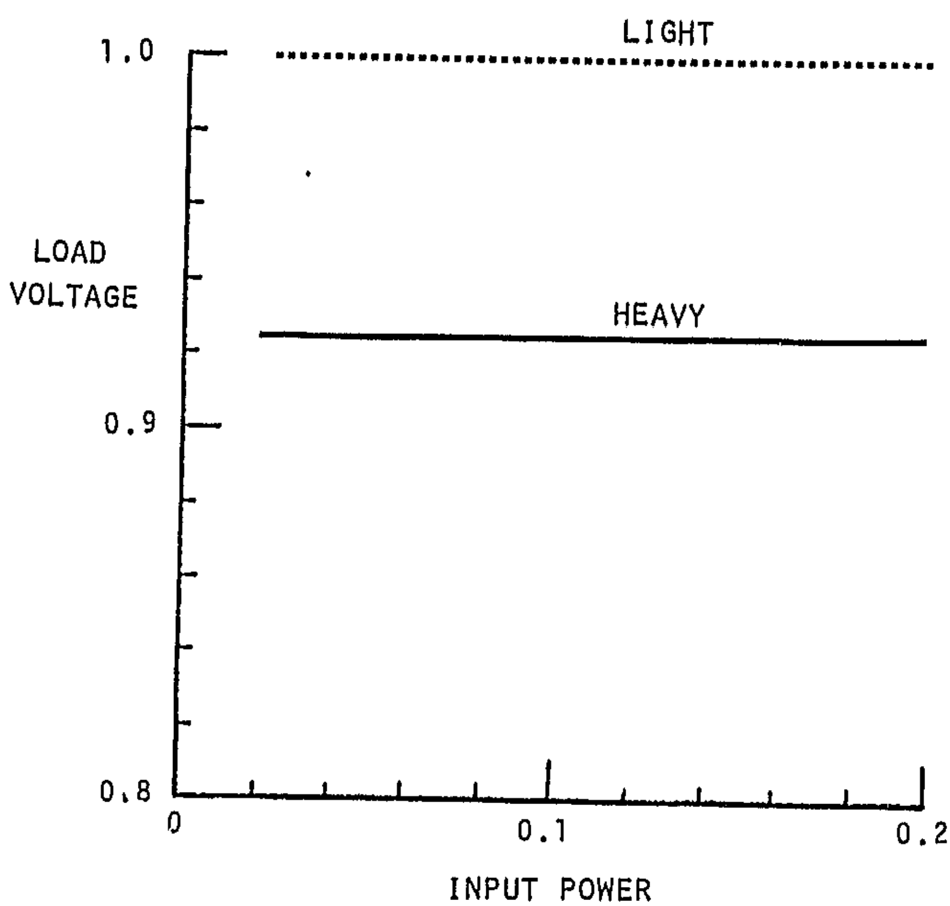

Figure 3-15. Load Voltage as a Function of Input Power, VS = 1
Synchronous Machine with Constant Excitation

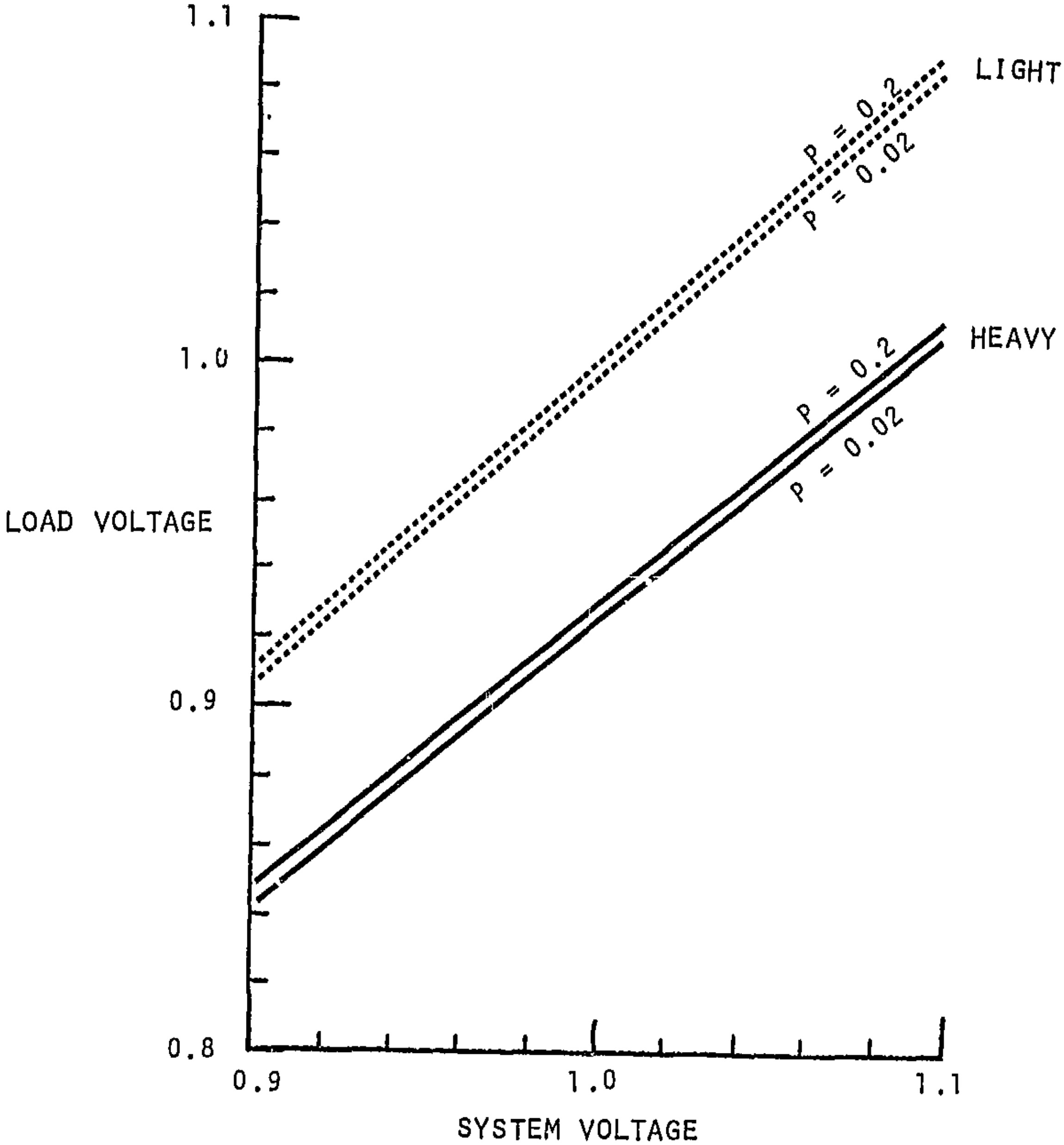

Figure 3-16. Load Voltage as a Function of System Voltage, Synchronous Machine with Constant Excitation

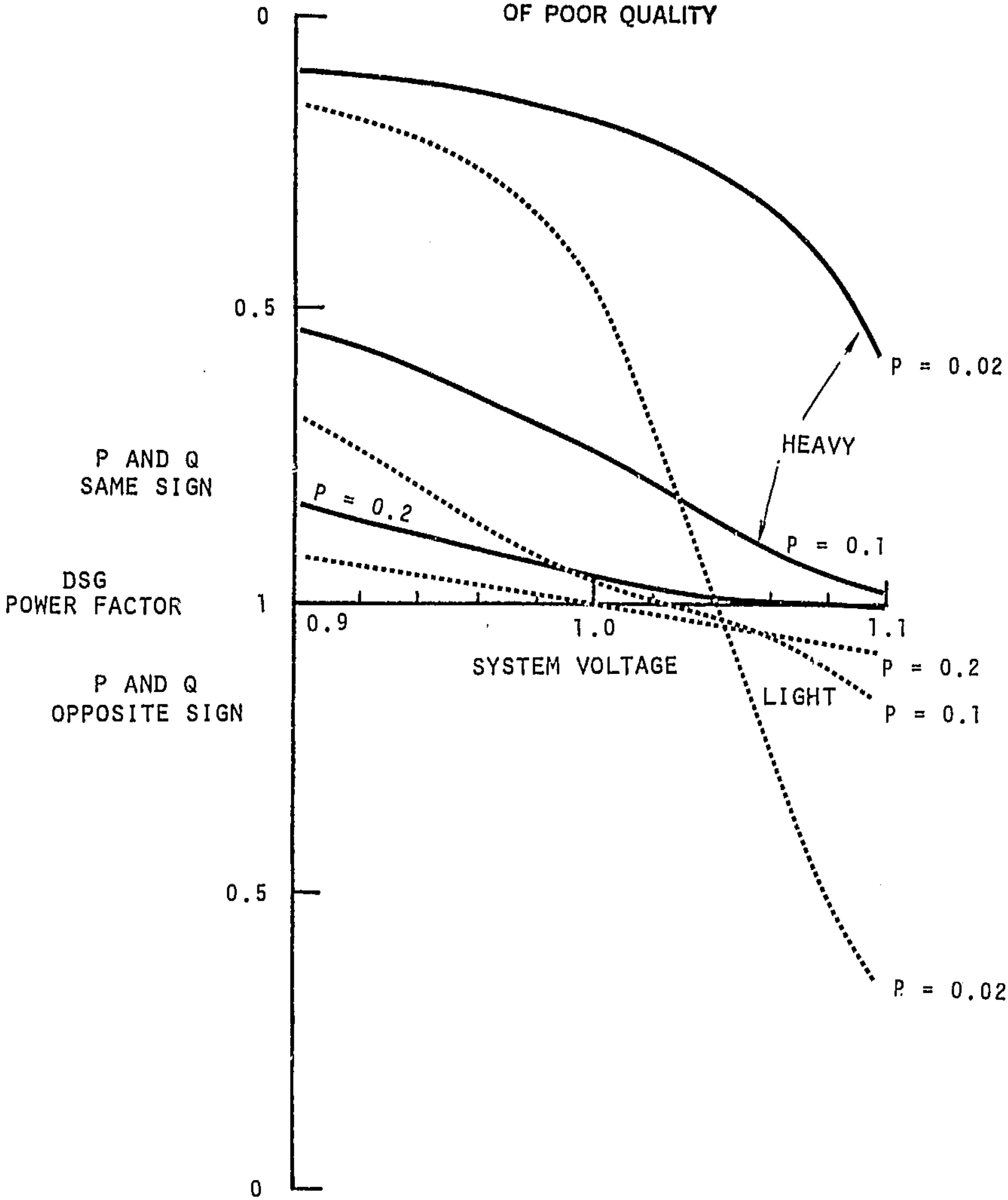

Figure 3-17. DSG Power Factor as a Function of System Voltage, Synchronous Machine with Constant Excitation

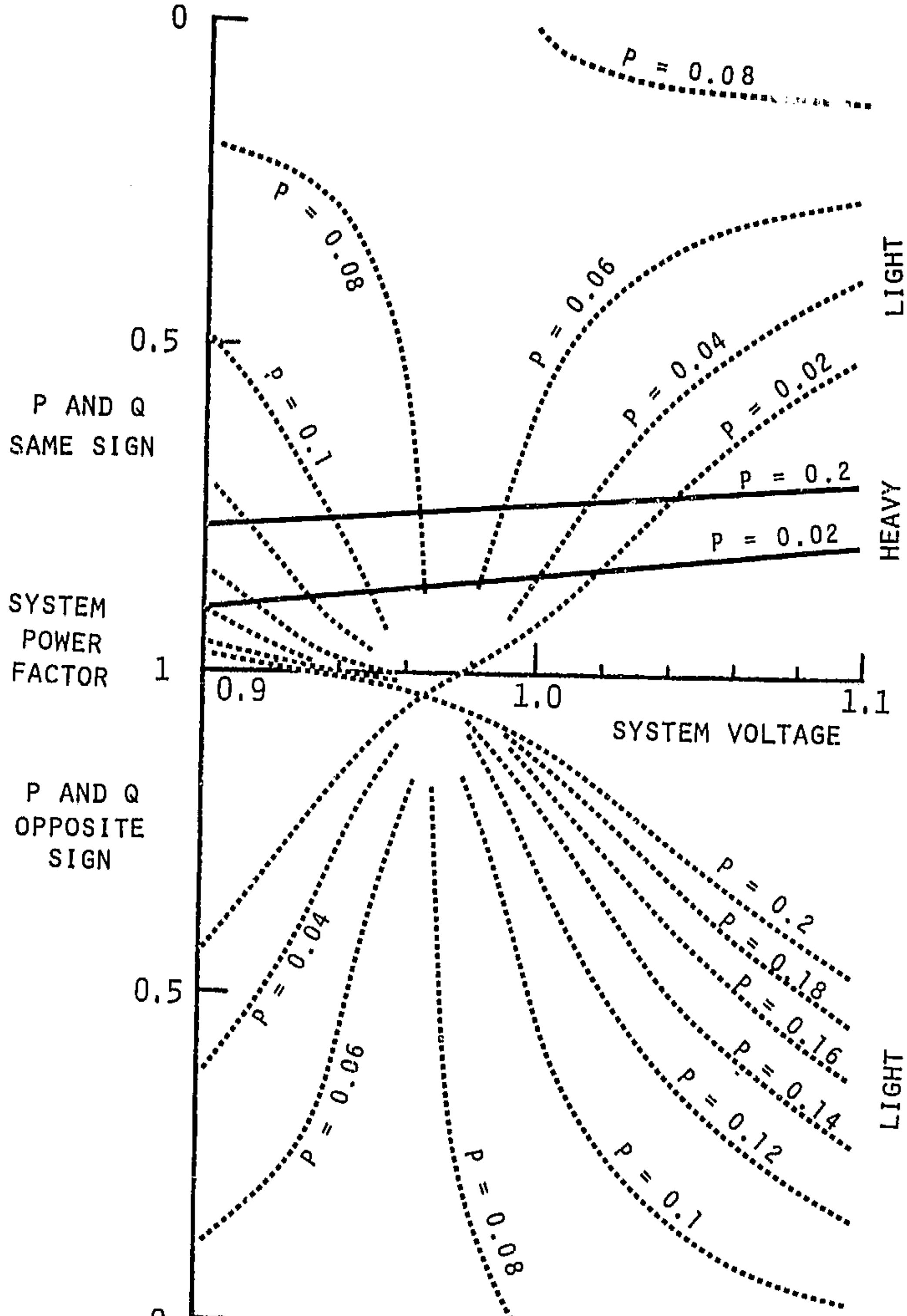

Figure 3-18. System Power Factor as a Function of System Voltage, Synchronous Machine with Constant Excitation

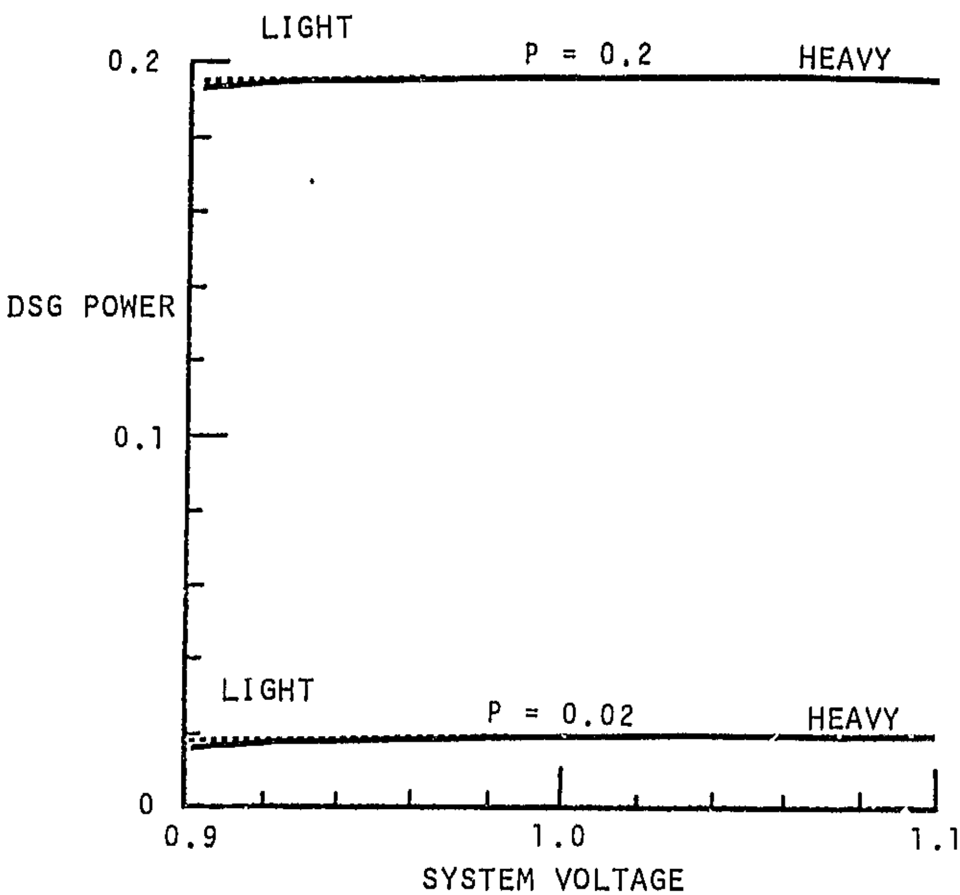

Figure 3-19. DSG Power as a Function of System Voltage, Synchronous Machine with Constant Excitation

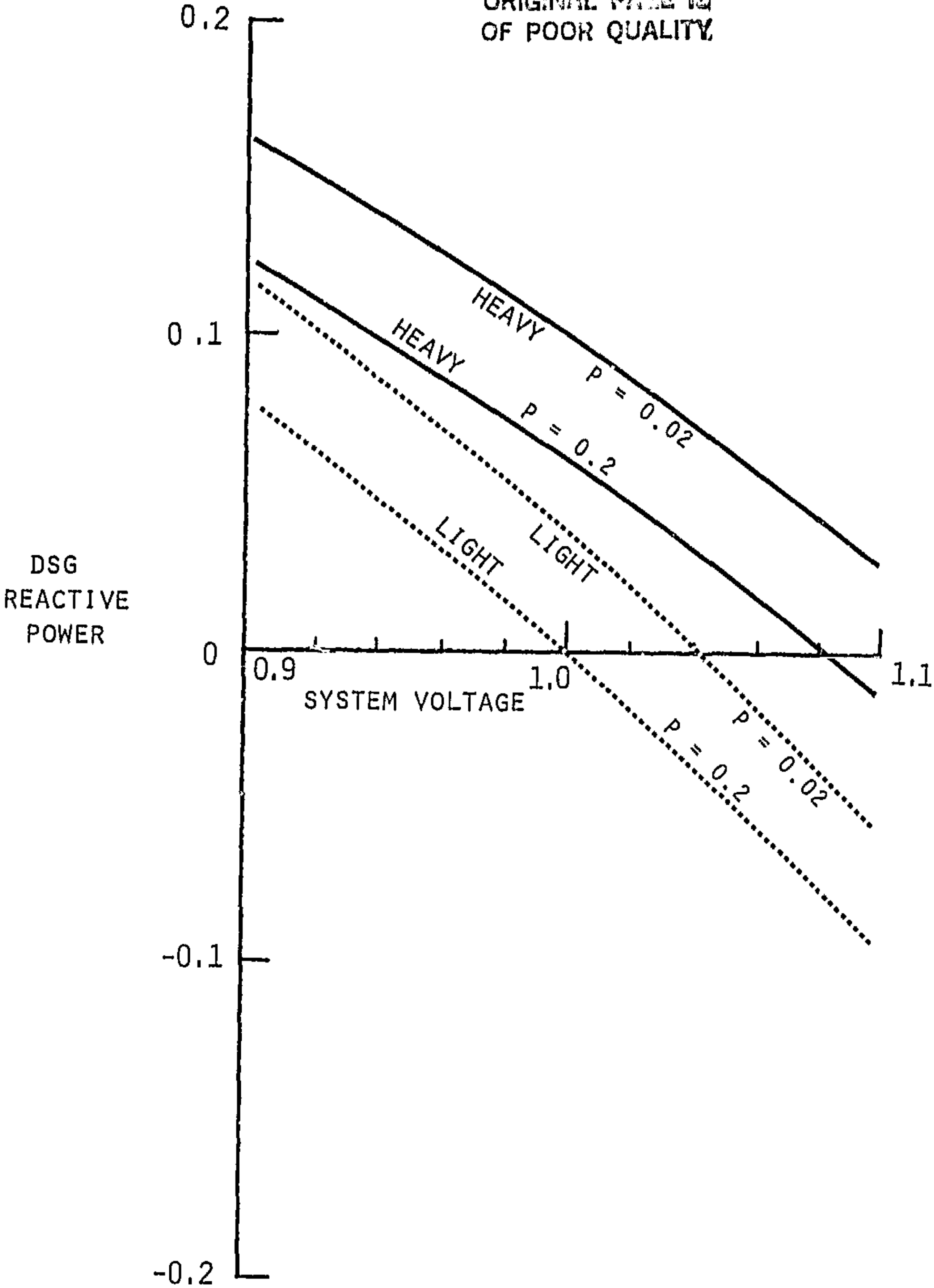

Figure 3-20. DSG Reactive Power as a Function of System Voltage, Synchronous Machine with Constant Excitation

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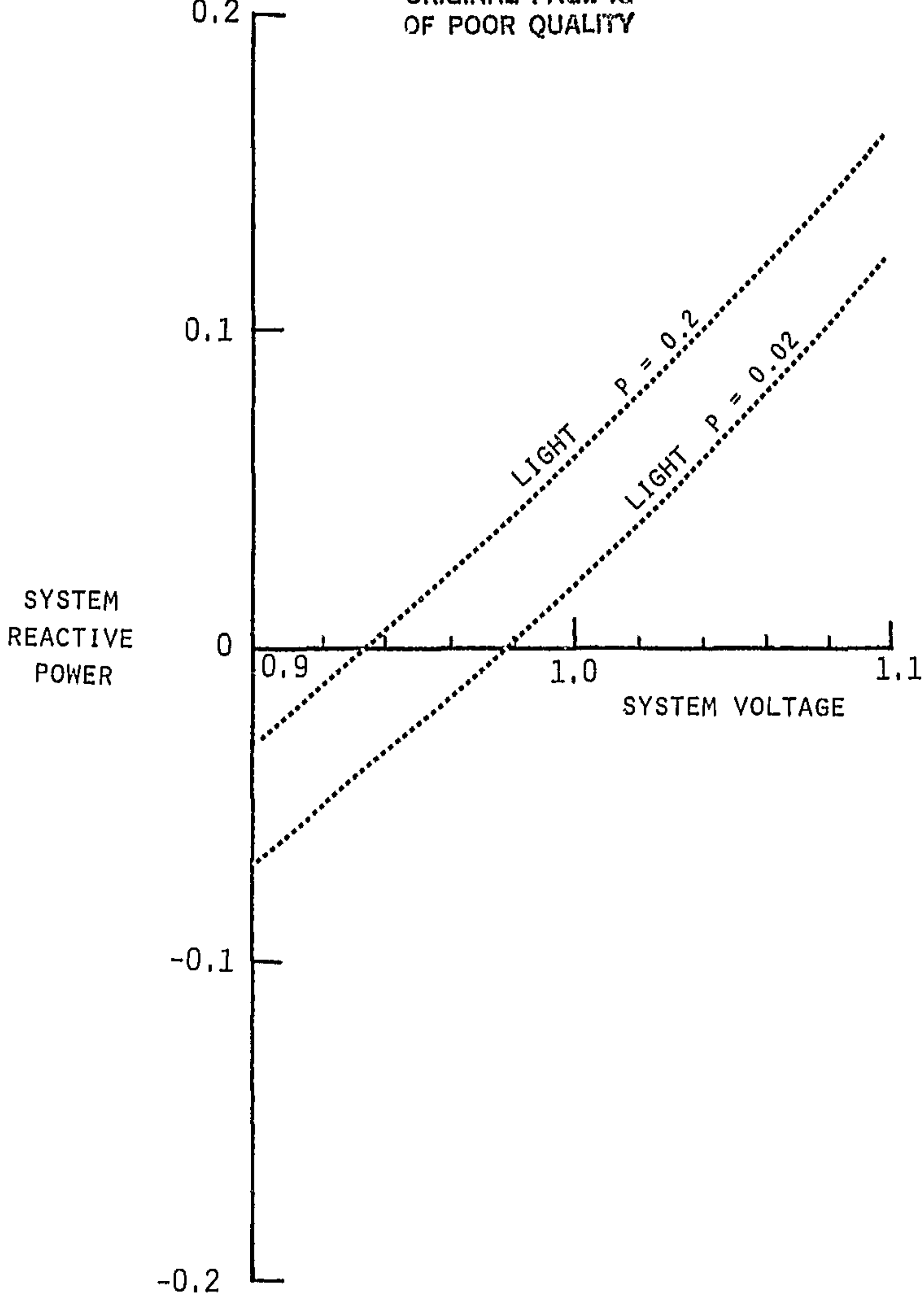

Figure 3-21. System Reactive Power as a Function of System Voltage, Synchronous Machine with Constant Excitation

Induction generator

The rotating field for the 'excitation' of an induction generator is drawn from the system to which the machine is connected. The generator always consumes reactive power, but in amounts which depend upon the power output as well as the terminal voltage. Voltage variations as a function of DSG power might therefore be expected. The results are shown in Figure 3-22.

It can be seen in Figure 3-22 that the load voltage does vary with input power to some extent. It may be that this is partly because the DSG reactive demand increases as the power output increases, thereby loading the system down with reactive current as it unloads the real power.

This reactive power is shown in Figure 3-23.

Figure 3-23 shows that the DSG reactive consumption varies strongly with DSG power and system voltage. The large consumption of reactive power is associated with a large slip, as shown in Figure 3-24.

Maximum power output from the generator occurs with a slip of about -5%, and for some values of system voltage at heavy system load the DSG input power exceeded the peak power capability of the machine. As a result, convergence was not obtained for system voltage below 1.0 pu, input power of 0.2 pu and full load on the system or below 0.92 pu volts with input power of 0.2 pu and light load on the system. Convergence was otherwise satisfactorily obtained, indicating that the machine parameters were appropriately chosen for an input power of 0.2 pu.

Since a characteristic of the induction generator is that its reactive demand increases as the real power output increases, and decreases as the terminal voltage increases, its power factor does not vary very much as these parameters vary. This is shown in Figure 3-25.

The system power factor, as shown in Figure 3-26, is quite poor except when the DSG is making only a slight contribution to the load. The power factor is so poor because the DSG consumes reactive power.

In spite of the reactive demand, the load voltage varies with the system voltage in much the same way as the constant Q generator. This is shown in Figure 3-27 .

The induction generator, like the constant power factor synchronous generator. is reasonably efficient. As shown in Figure 3-28, the DSG output power remains close to the input power, independent of the system voltage.

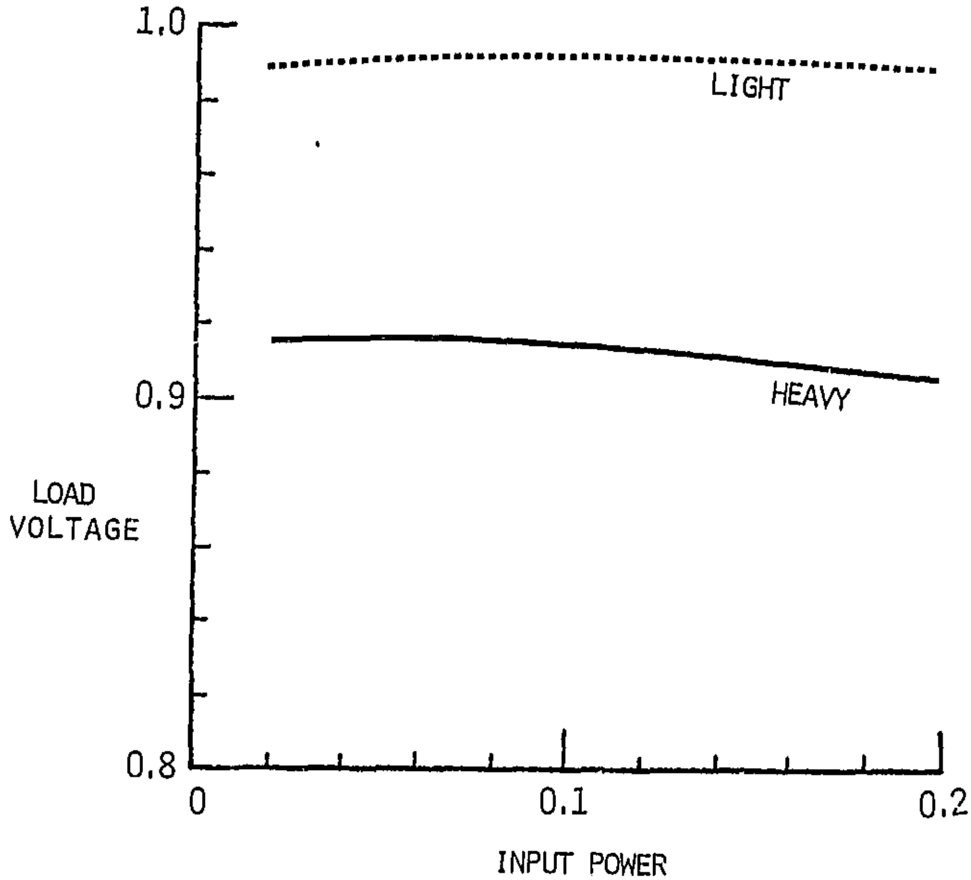

Figure 3-22. Load Voltage as a Function of Input Power, VS = 1
Induction Generator

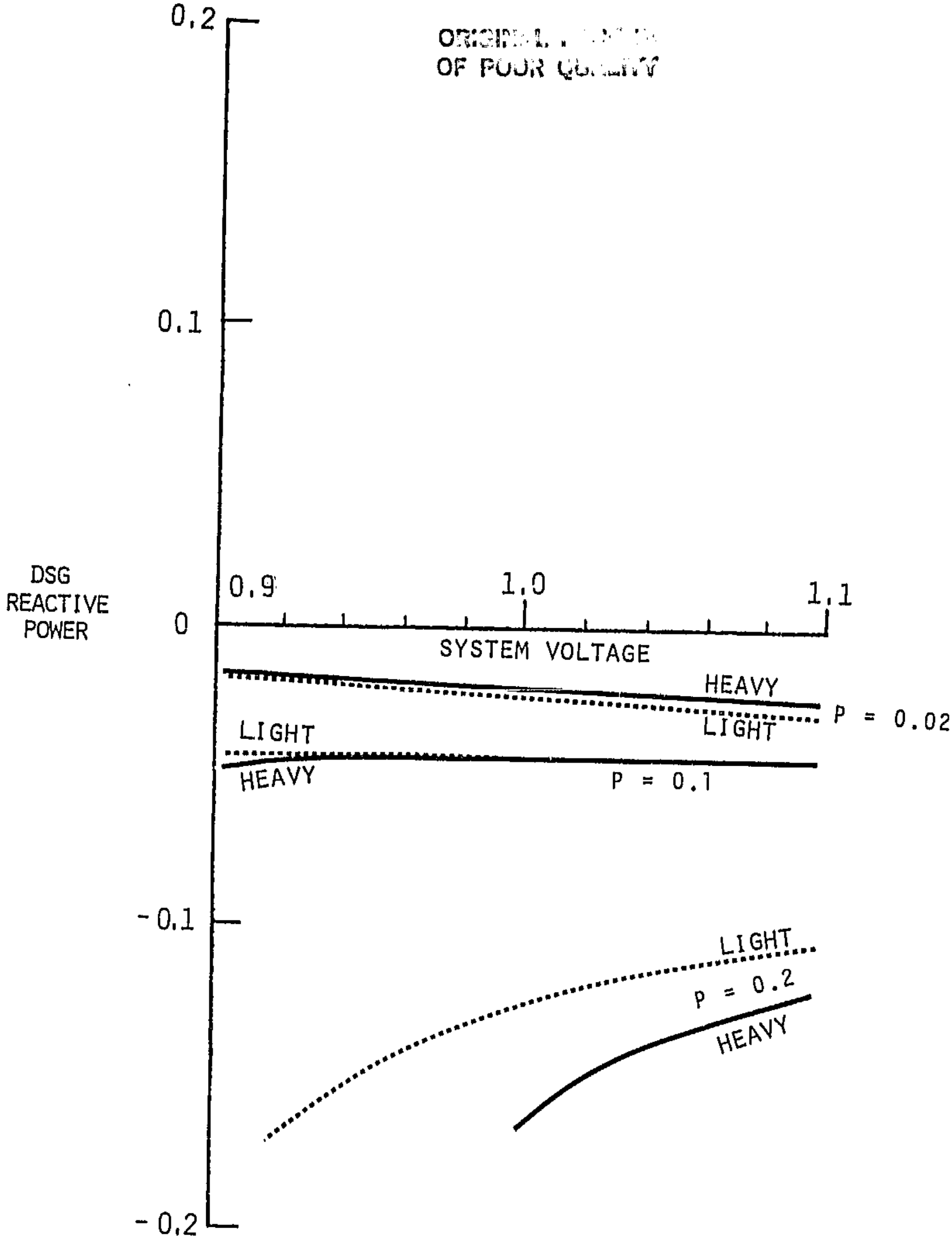

Figure 3-23. DSG Reactive Power as a Function of System Voltage, Induction Generator

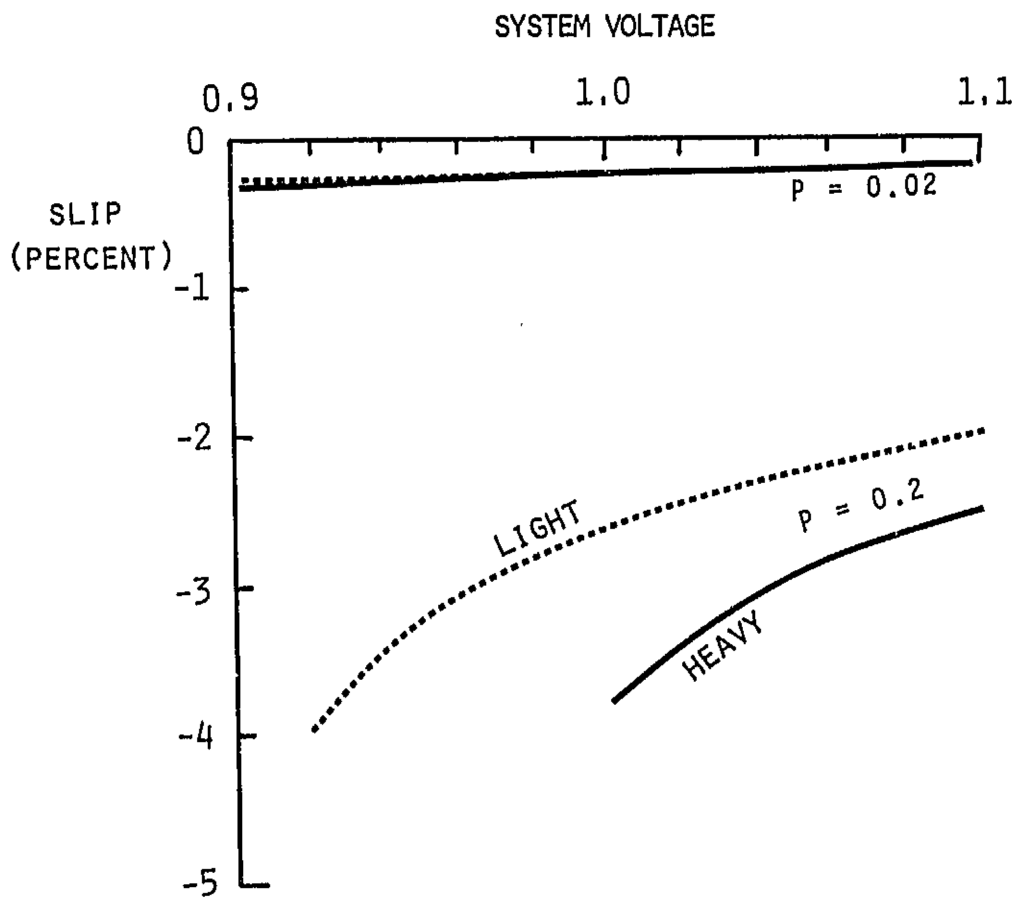

Figure 3-24. Slip as a Function of System Voltage, Induction Generator

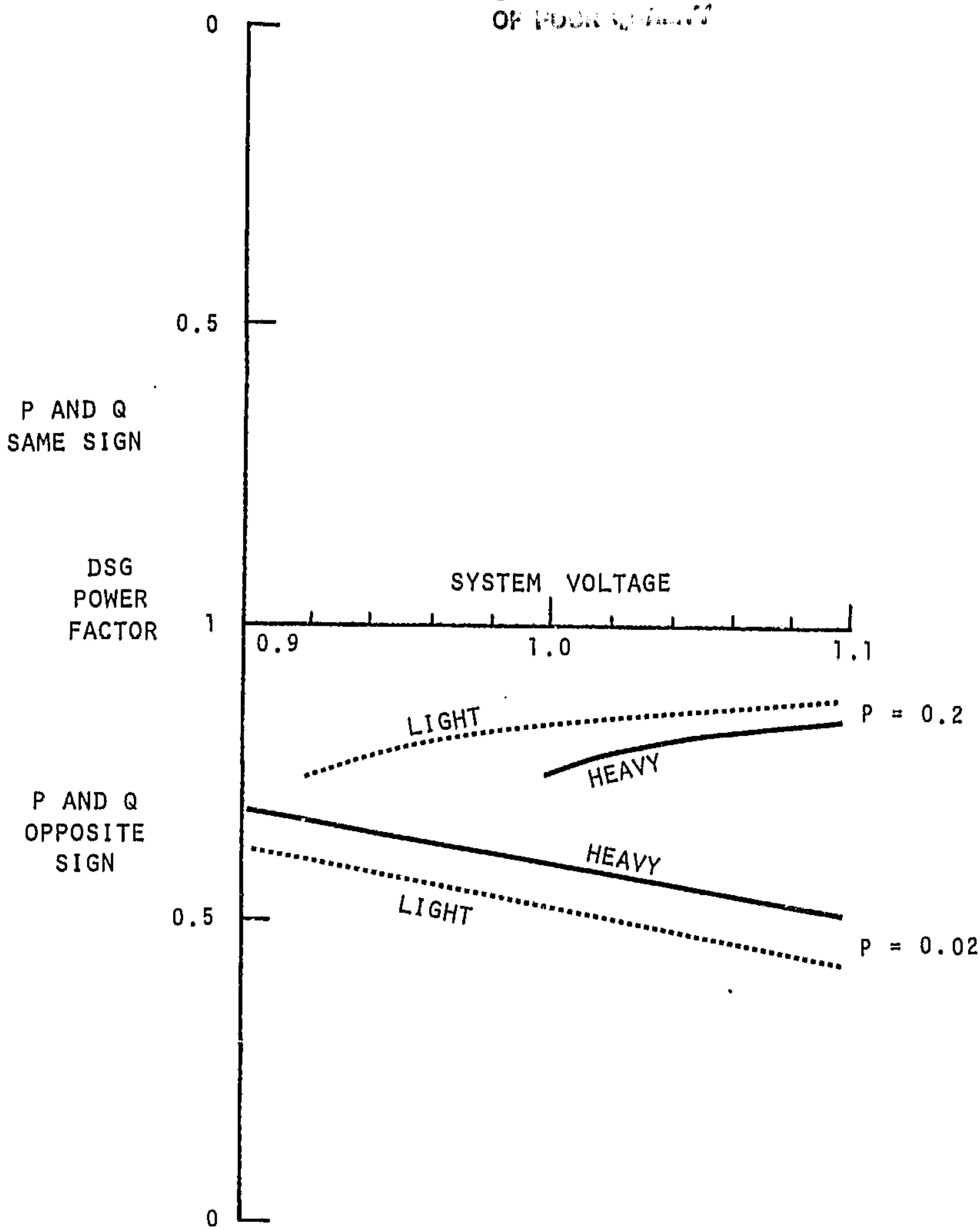

Figure 3-25. DSG Power Factor as a Function of System Voltage, Induction Generator

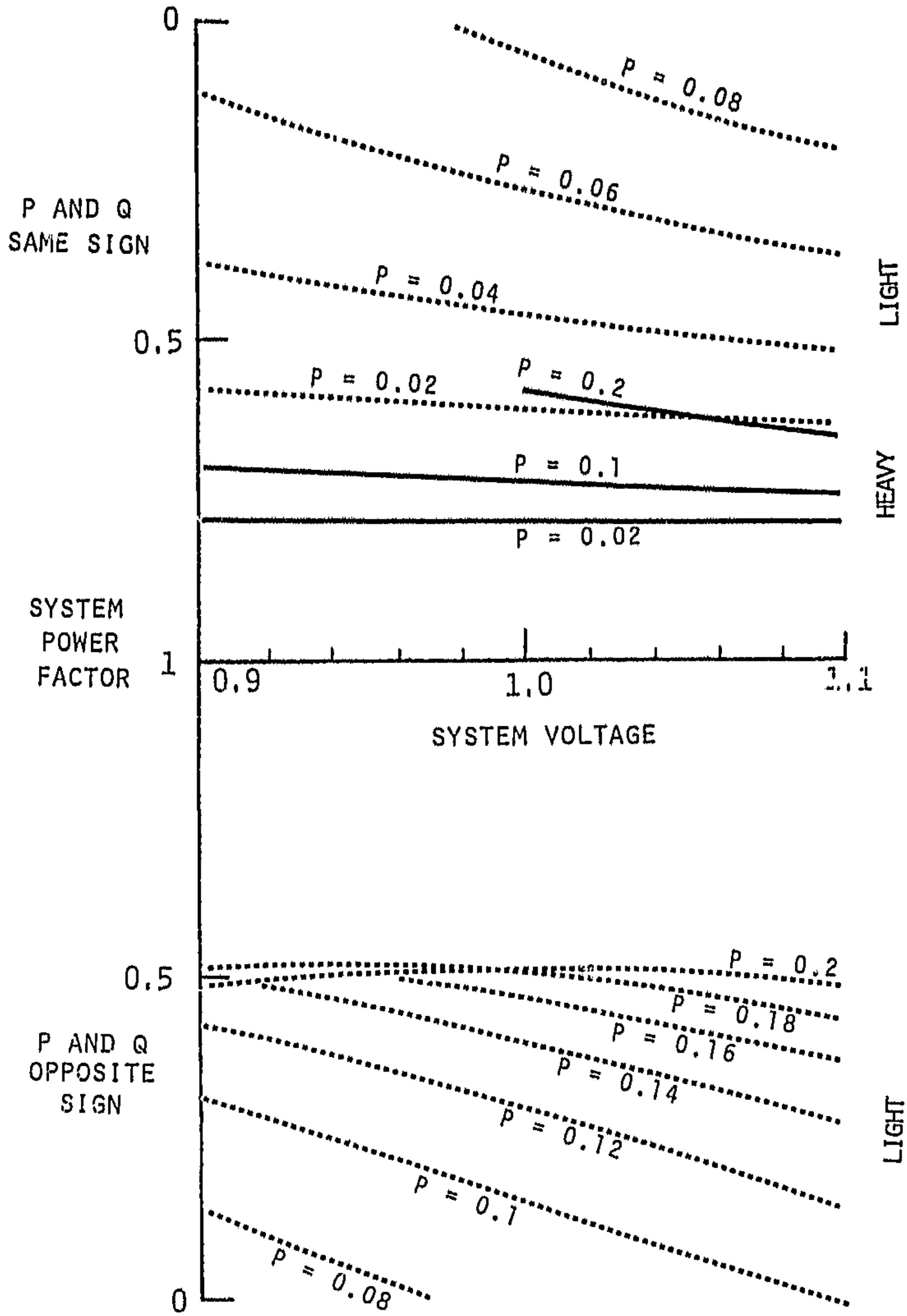

Figure 3-26. System Power Factor as a Function of System Voltage, Induction Generator

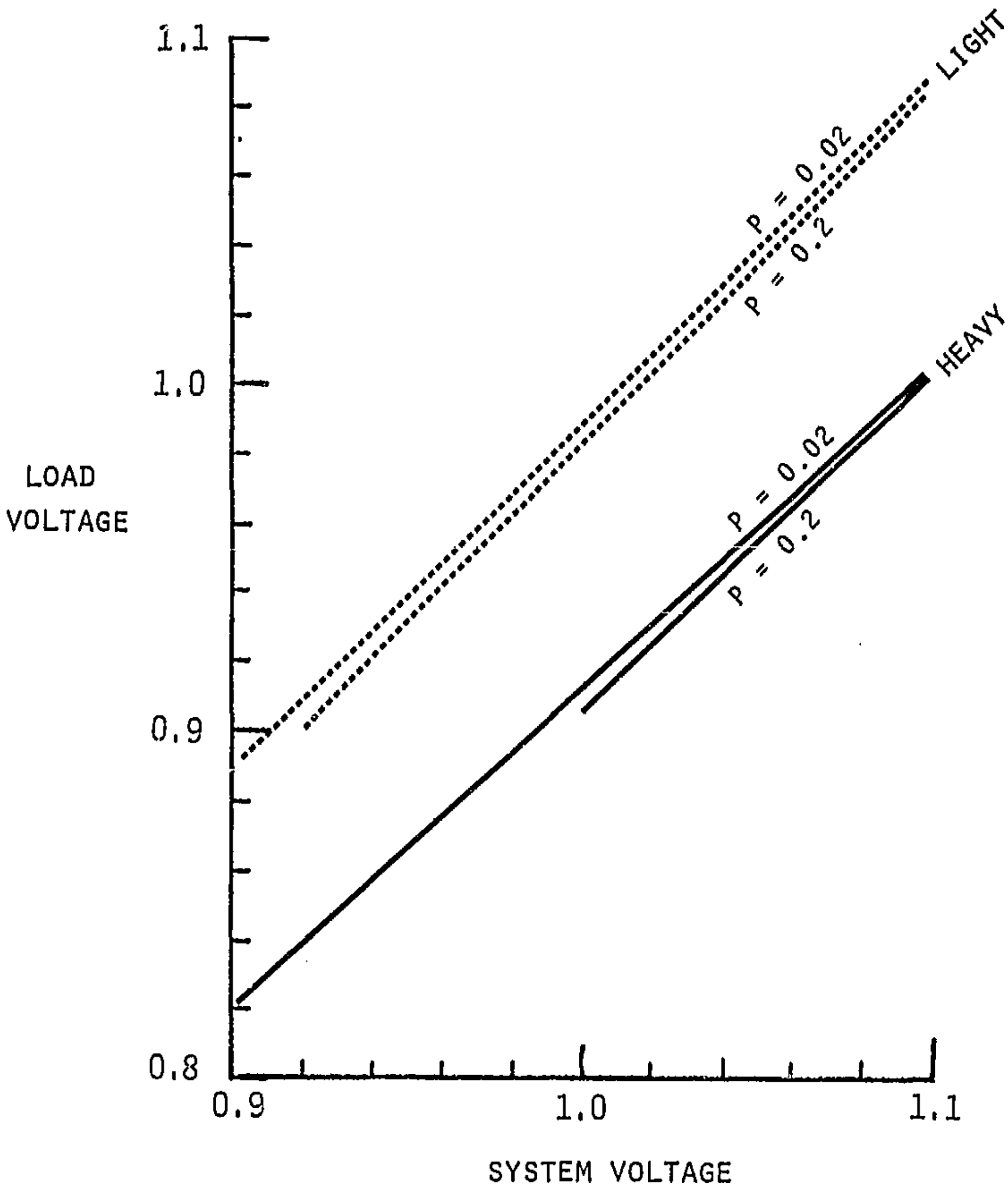

Figure 3-27. Load Voltage as a Function of System Voltage, Induction Generator

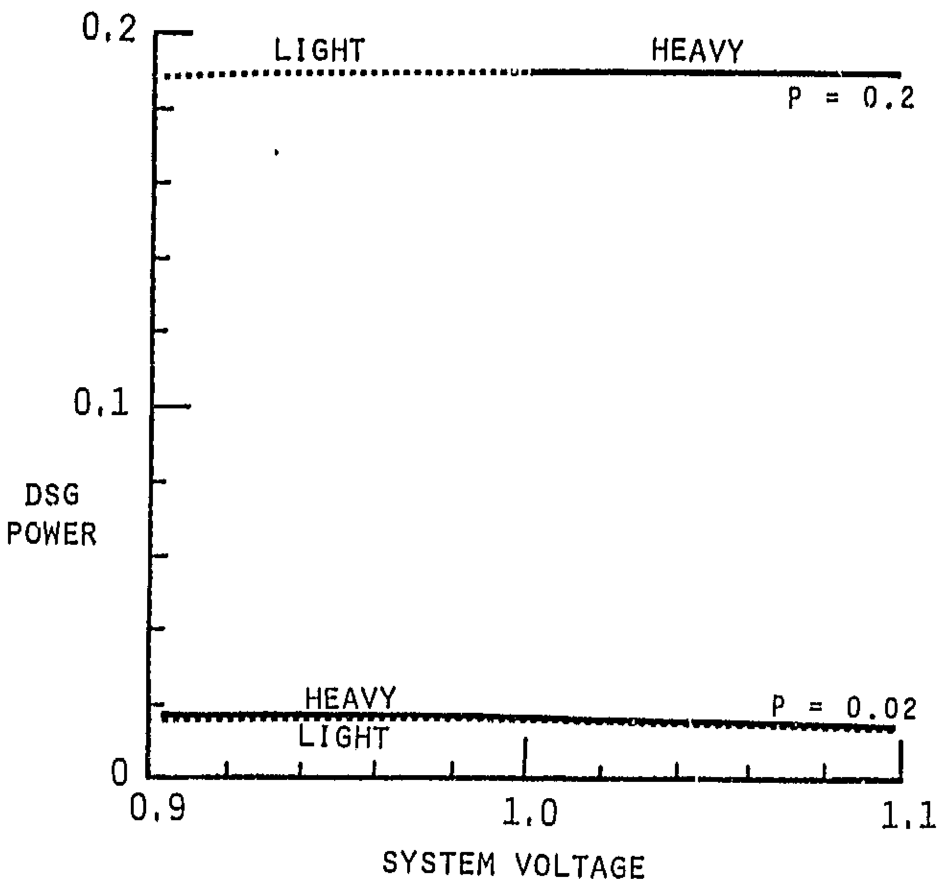

Figure 3-28. DSG Output Power as a Function of System Voltage, Induction Generator

Compensated Induction Generator

The compensated induction machine gives a somewhat better performance in terms of load voltage against input power than the uncompensated machine. This is shown in Figure 3-29. It may also be added that the load voltage for both heavy and light load is somewhat higher than for the uncompensated induction generator because of the power factor correcting capacitor.

The DSG reactive, instead of being uniformly negative as in the uncompensated version, is now positive for low output powers and may be positive or negative for higher output powers, depending on the system voltage. Again the effect is clearly due only to the power factor correcting capacitor. This is shown in Figure 3-30.

Figure 3-31 shows the slip for the compensated induction generator. Of course, any difference between the slip curves of the compensated generator and the uncompensated generator are due to changes in the terminal voltage and, since the slip is largely determined by the power generated by the machine, these slip curves are not significantly different from the slip curves for the uncompensated generator. It may also be added that the same range of operation was obtained — that is to say, the improvement in terminal voltage due to the power factor correcting capacitor was not sufficient to extend the range of the generator below 1 pu system volts at heavy load and full power, or below 0.92 pu system volts at light load and full power.

The DSG power factor is shown in Figure 3-32. For full power, or 0.2 pu power on the generator, the DSG power factor is uniformly good, and very close to unity, because of the correcting capacitor. However, at smaller values of power output, the reactive drawn by the generator itself is smaller and the system as a whole is over-corrected. As a result, the DSG's apparent power factor is rather poor.

The system power factor, shown in Figure 3-33, is reasonably good for most values of DSG power and system voltage. Only when the DSG output almost exactly balances the real component of load is the system power factor poor, so that unless the DSG power output is about 50% of its rated value, in this example, the system power factor is quite reasonable.

The variation in load voltage with system voltage, shown in Figure 3-34, is quite similar to the variations for the uncompensated generator. The difference is that, in this case, the voltages are all slightly higher.

The variation in DSG power with system voltage shown in Figure 3-35 is very similar to the variations seen in the case of the induction generator. This should not be surprising, since the only difference would be due to the slight change in slip resulting from the slight change in terminal voltage.

Figure 3-36 shows the system reactive power for light load as a function of the system voltage. The system absorbs reactive power when the generator is putting out less than rated power, and is not called on to generate a significant amount of reactive when the generator is at full output. This contrasts with the case of the uncompensated generator, where even at light load the system is required to furnish between 0.1 and 0.2 pu reactive power all the time.

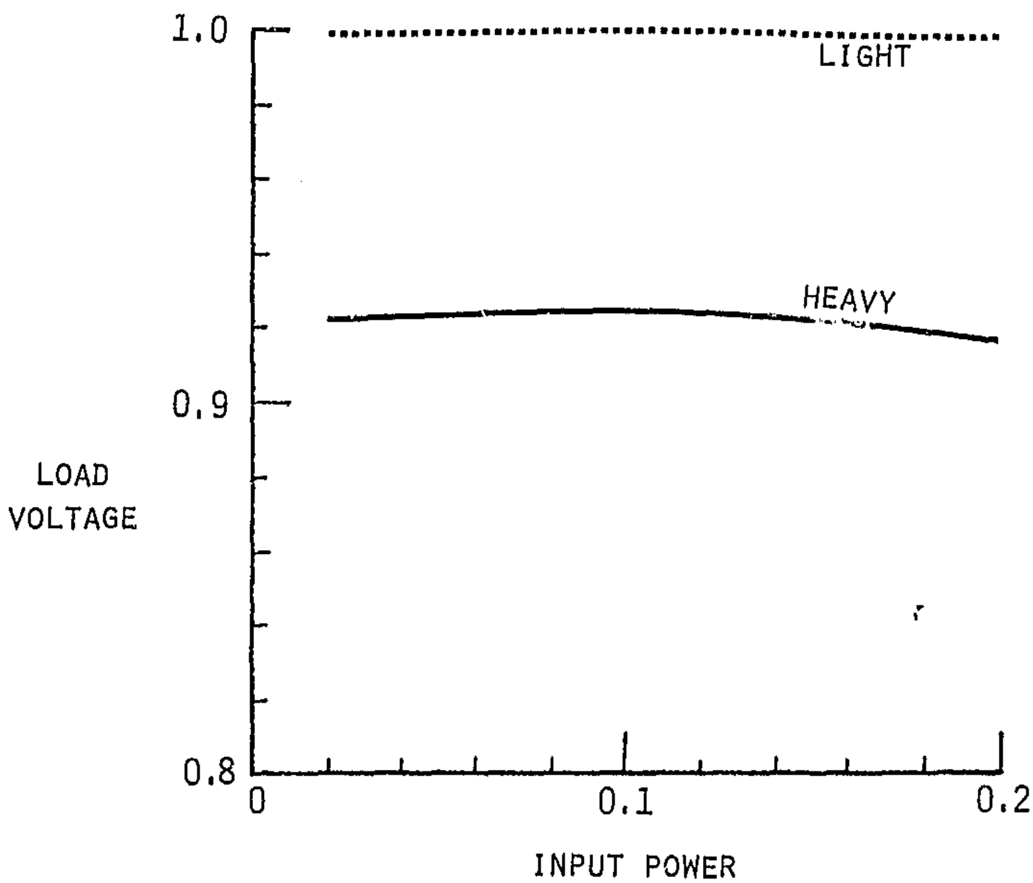

Figure 3-29. Load Voltage as a Function of Input Power, VS = 1
Compensated Induction Generator

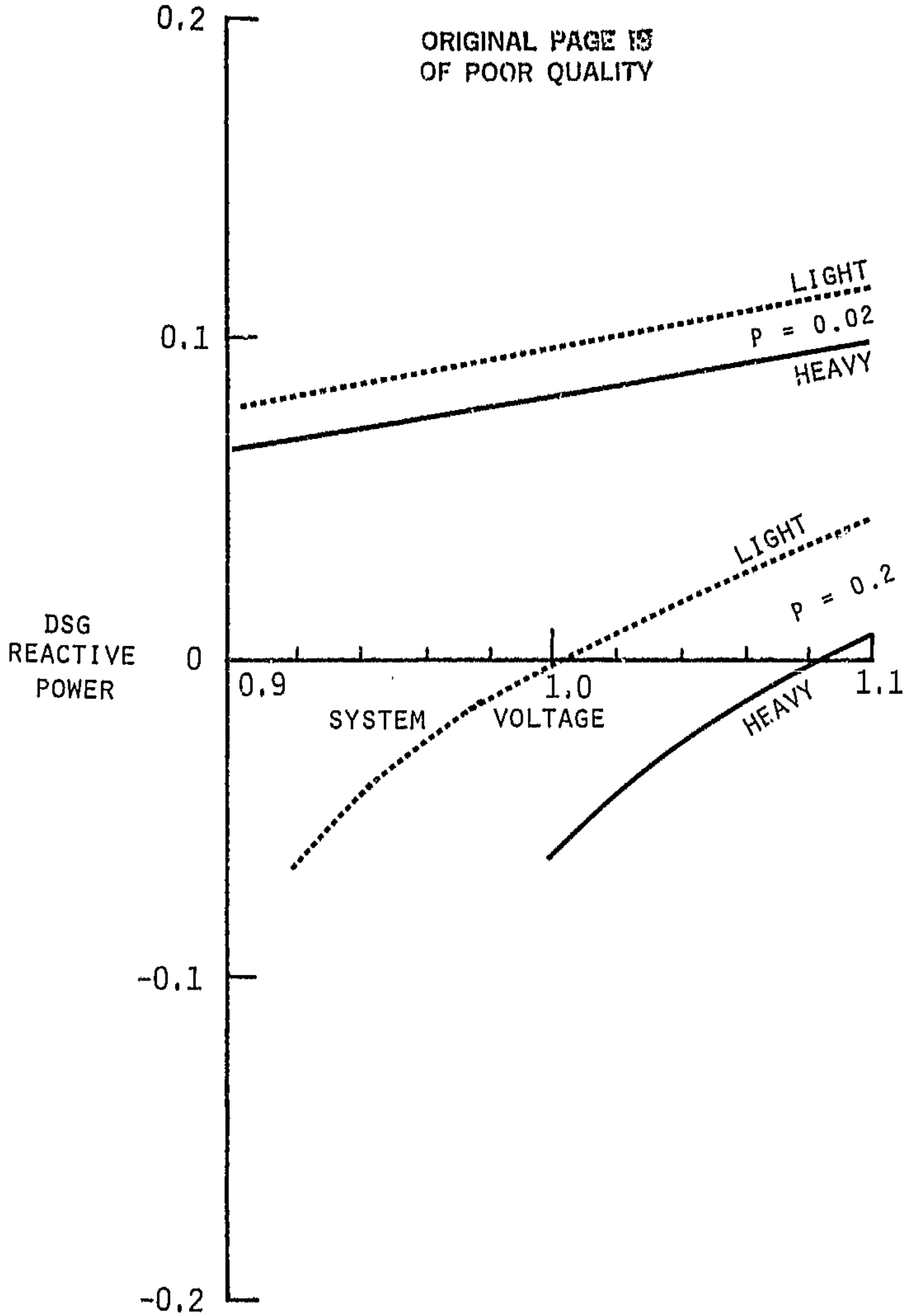

Figure 3-30. DSG Reactive Power as a Function of System Voltage, Compensated Induction Generator

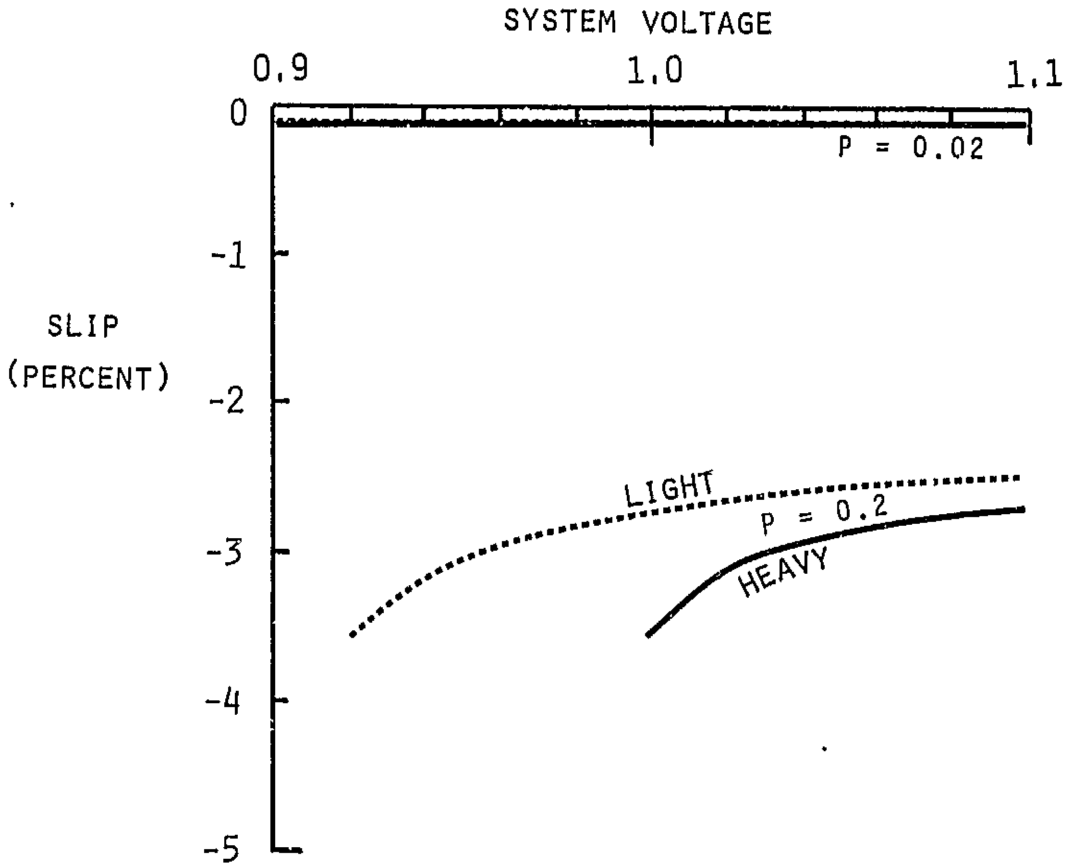

Figure 3-31. Slip as a Function of System Voltage, Compensated Induction Generator

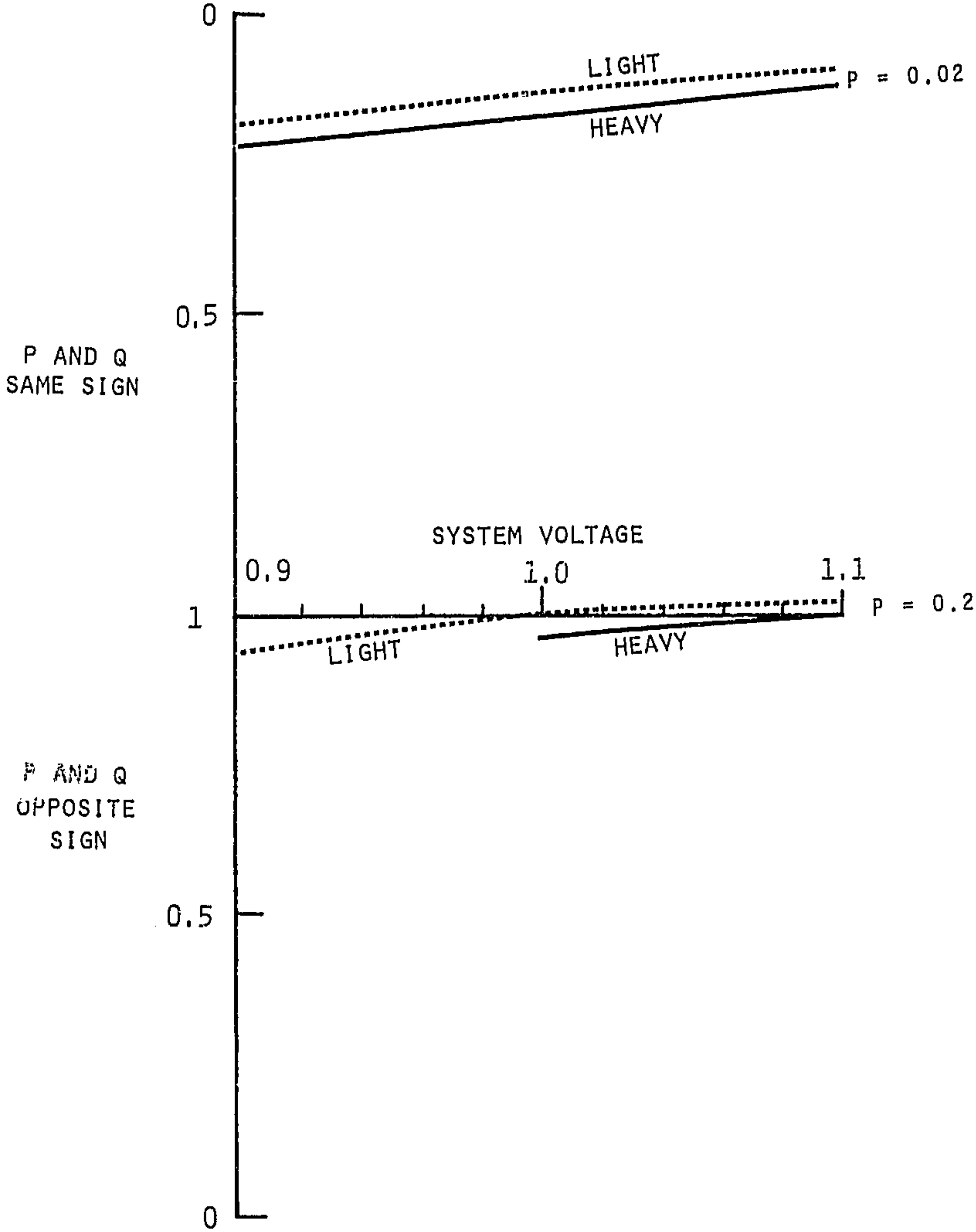

Figure 3-32. DSG Power Factor as a Function of System Voltage, Compensated Induction Generator

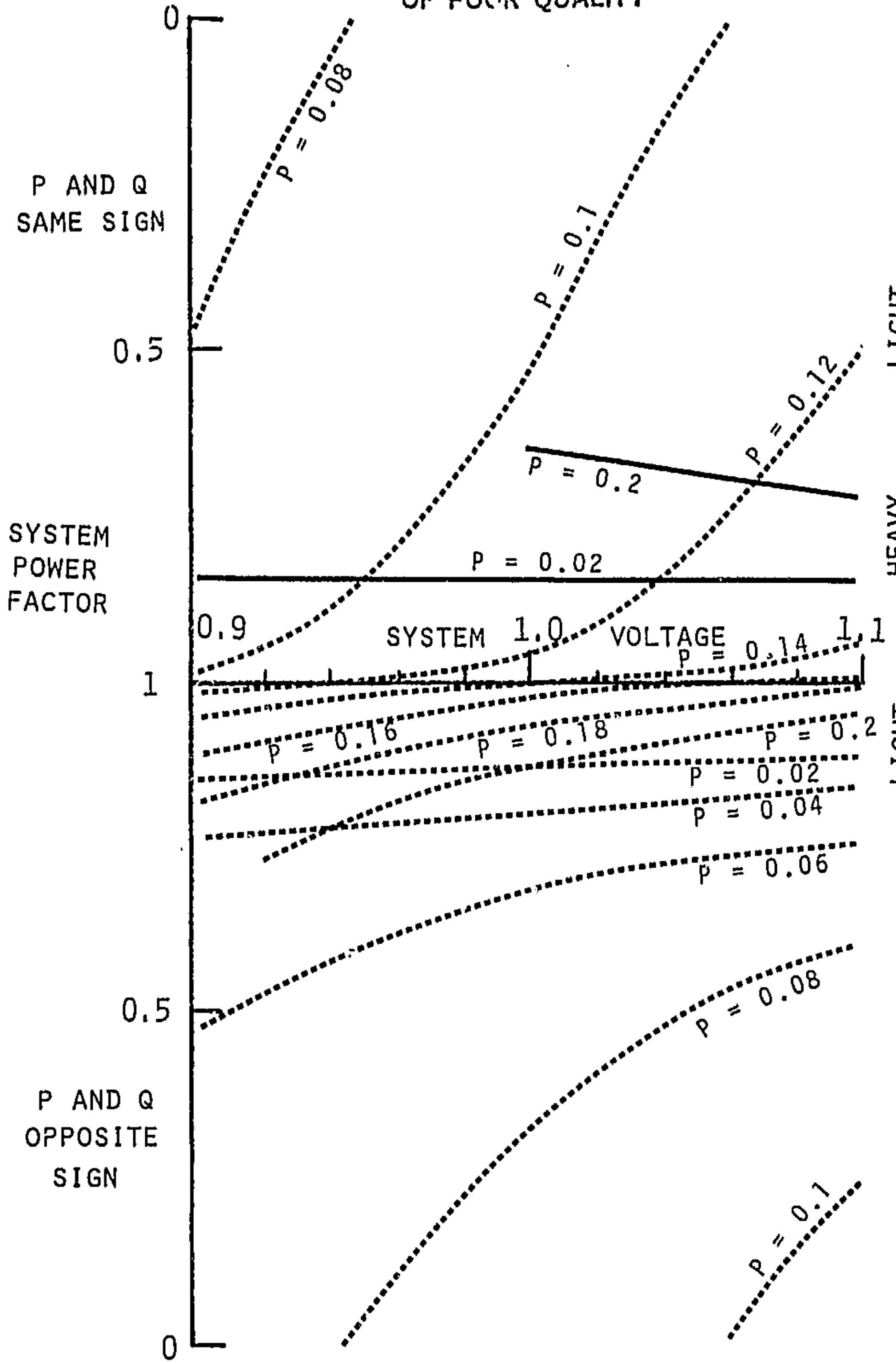

Figure 3-33. System Power Factor as a Function of System Voltage, Compensated Induction Generator

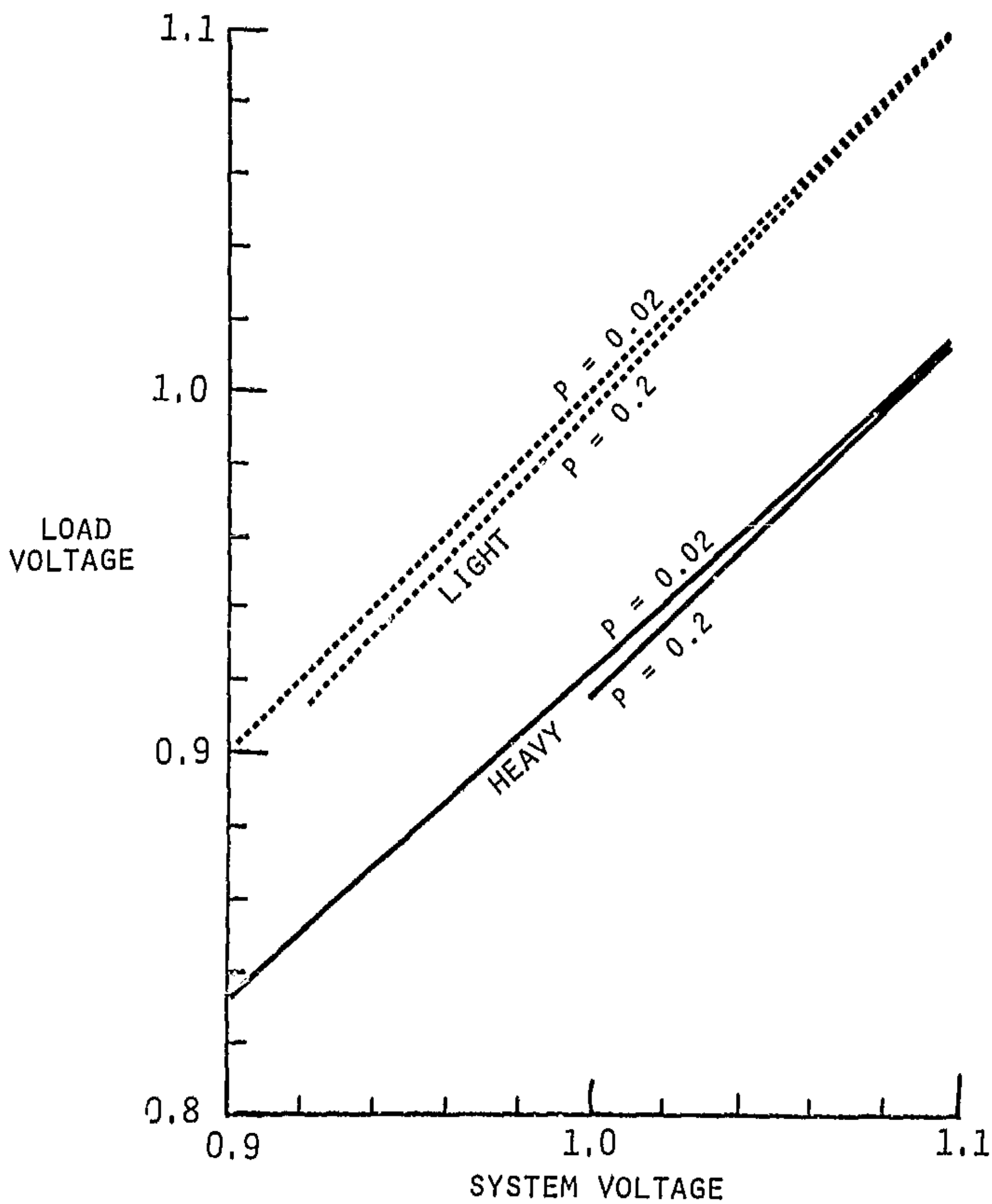

Figure 3-34. Load Voltage as a Function of System Voltage, Compensated Induction Generator

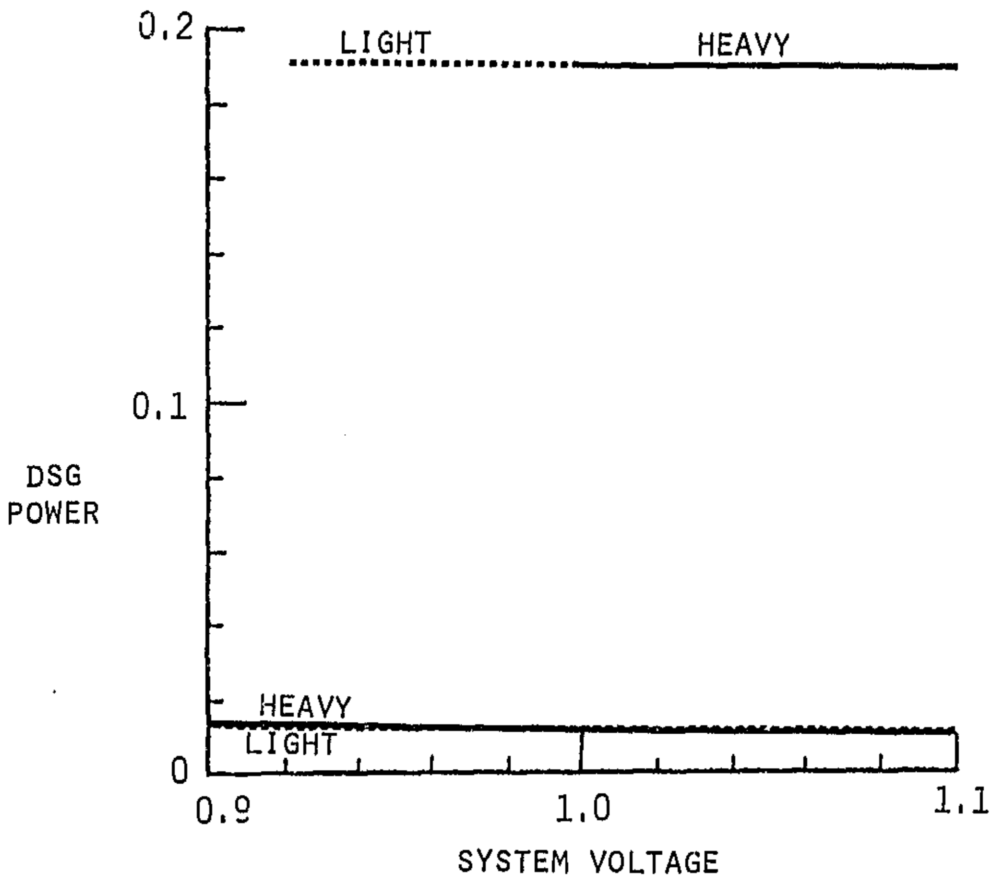

Figure 3-35. DSG Output Power as a Function of System Voltage, Compensated Induction Generator

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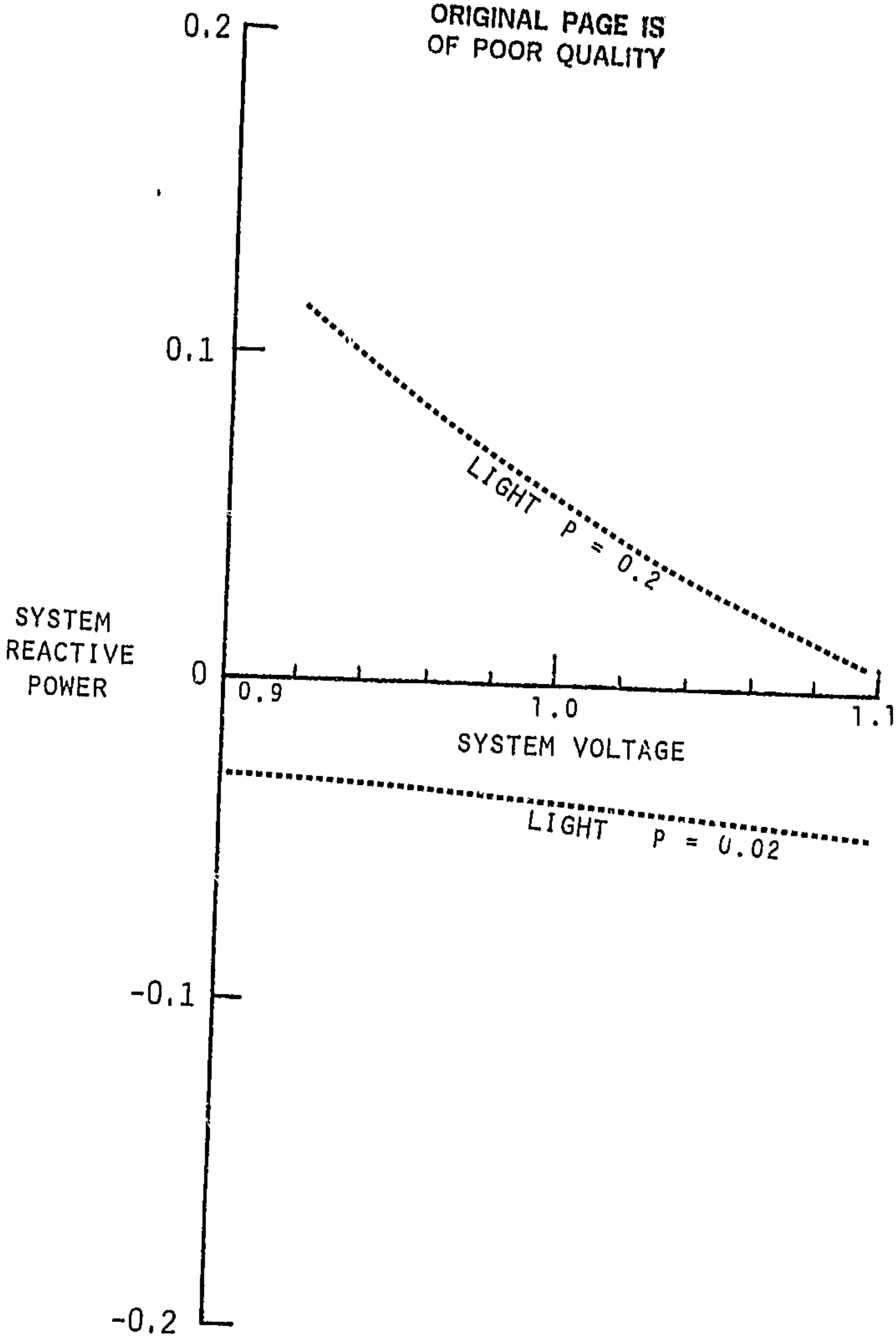

Figure 3-36. System Reactive Power as a Function of System Voltage, Compensated Induction Generator

DC/AC Inverter: Constant Extinction Angle Control

Constant extinction angle (CEA) control is a possible, perhaps even likely, control method for line-commutated inverters. Self-commutated inverters are represented in this study by the unity power factor synchronous machine, which they generally resemble.

The reactive demand of a CEA inverter is very nearly a constant fraction of the real power delivered. For extinction angles typically used, around 15°, this fraction is typically 50%. As with the induction generator, this reactive power demand does not cause a problem in the load voltage as the power delivered varies. This is shown in Figure 3-37.

Because of the rather simple inverter representation used, some of the graphs presented for the other DSGs cannot be derived for the CEA inverter. For example, the DSG power factor is, perforce, constant and the DSG reactive demand is independent of system voltage.

The load voltage varies with system voltage, as shown in Figure 3-38, much like the induction machine case.

The machine efficiency cannot be examined through the model used here.

Because the DSG picks up only the real component of the load, the system power factor can be quite poor over quite a broad range of power levels, and actually becomes zero when the real power is precisely matched by the DSG. This is shown in Figure 3-39. DSG power factor is not shown since it is constant (by assumption).

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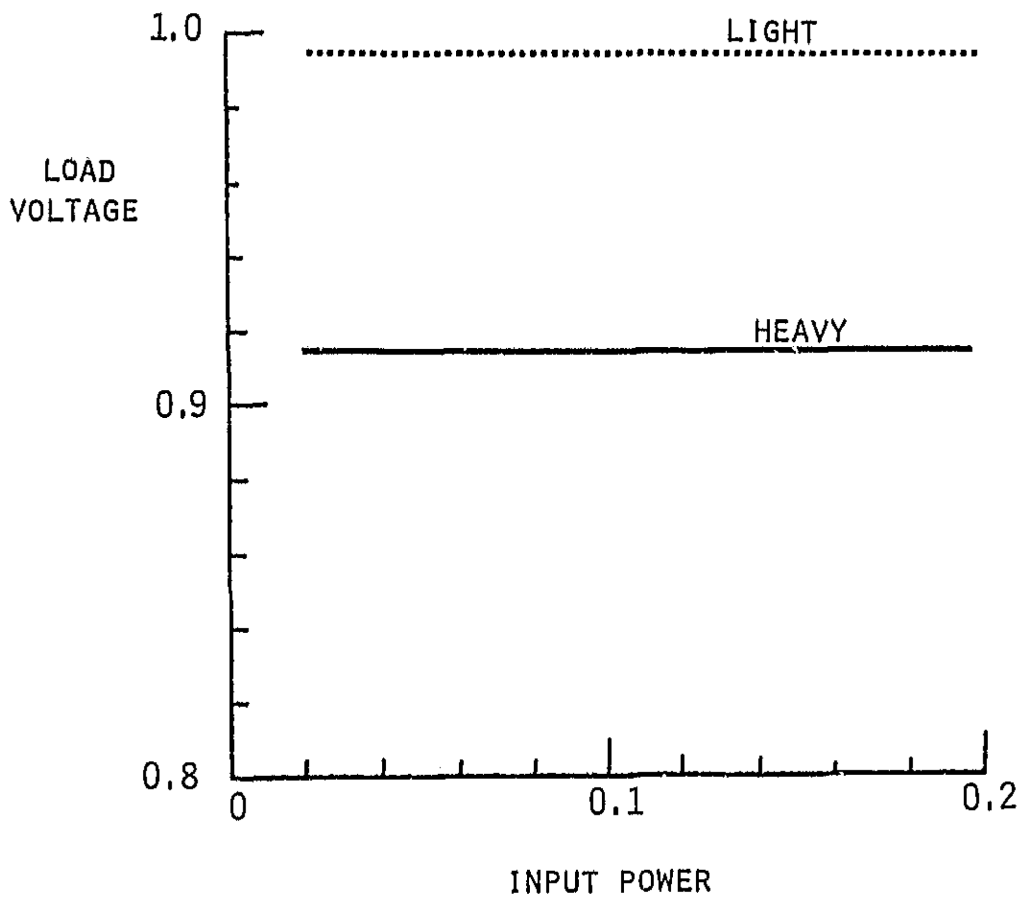

Figure 3-37. Load Voltage as a Function of Input Power, VS = 1
CEA Inverter

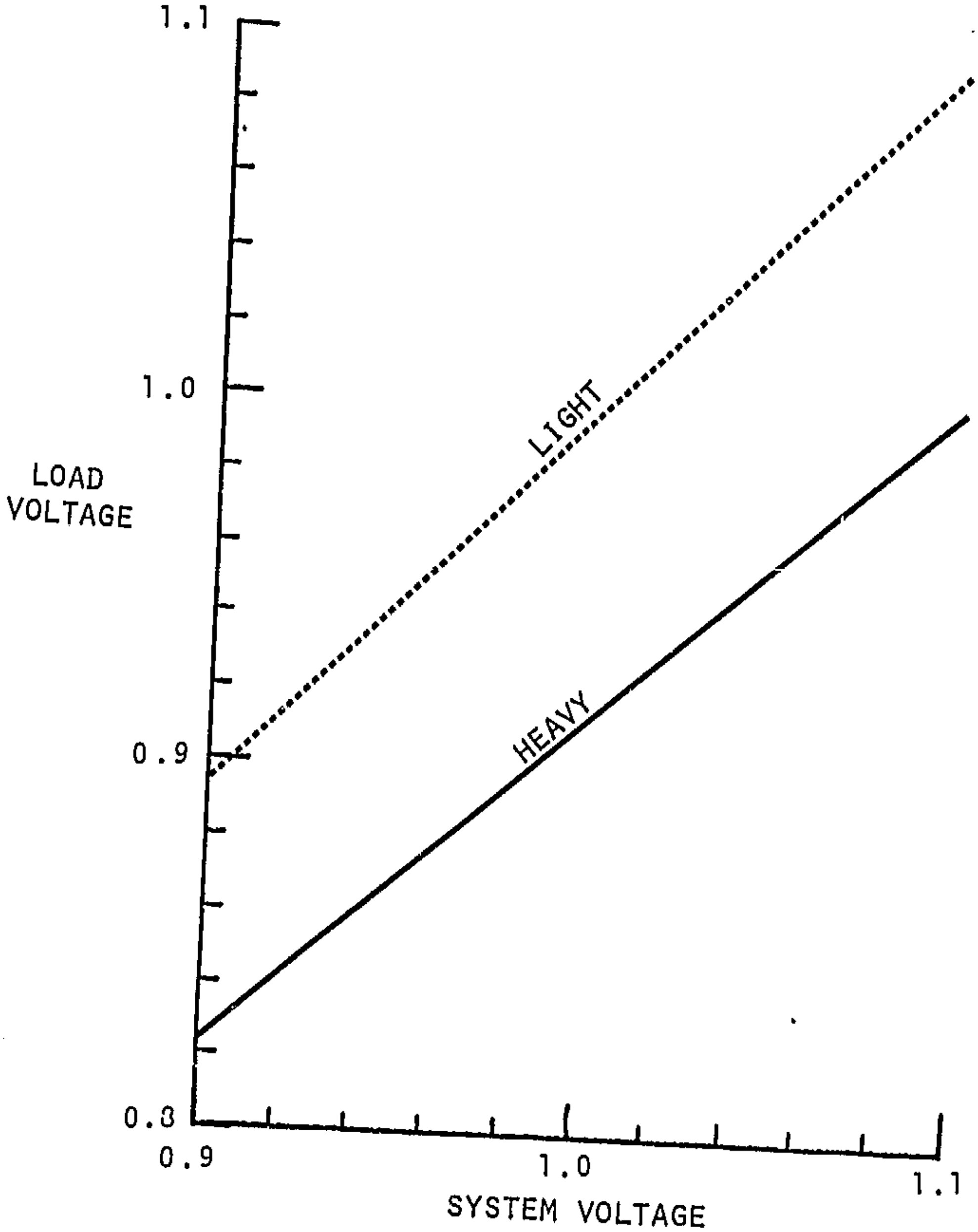

Figure 3-38. Load Voltage as a Function of System Voltage, CEA Inverter

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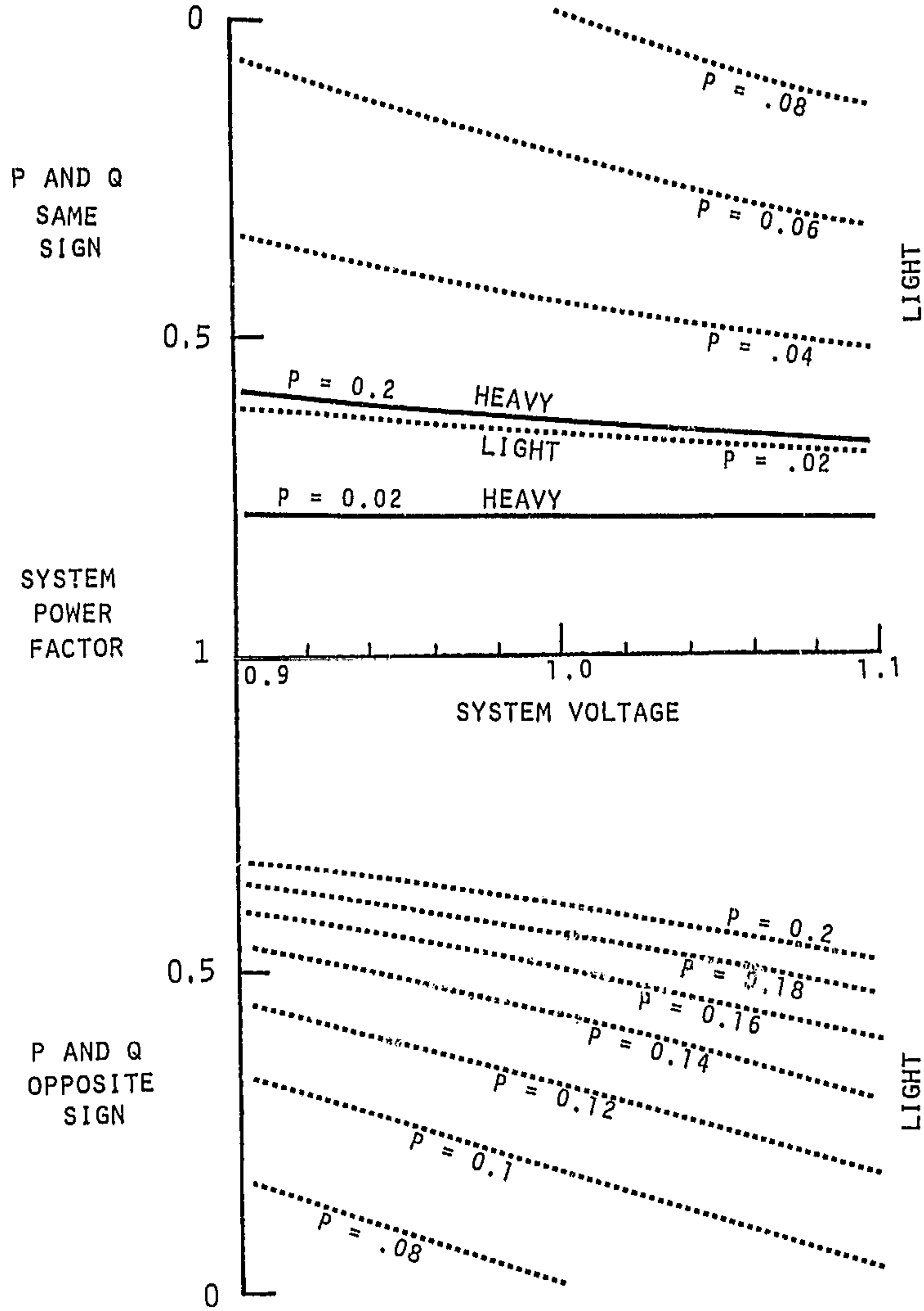

Figure 3-39. System Power Factor as a Function of System Voltage, CFA Inverter

Compensated CEA Inverter

Capacitor compensation can be applied to the CEA inverter to reduce its reactive demand. In the case examined here, a capacitor was added across the terminals of the inverter so that, at 1 pu voltage and 1 pu input power, the DSG presented unity power factor generation to the power system. As a result of this capacitor, the DSG is overcompensated for all lower values of input power, and operates at an (apparent) leading power factor. The power factor also becomes somewhat voltage-dependent.

As before, we begin by examining the variation of load voltage with input power, as in Figure 3-40.

Figure 3-40 shows that the compensated CEA inverter behaves somewhat differently than the other DSGs. Because of the fixed compensation, a considerable amount of voltage support is provided at low power inputs, and the voltage at the load is quite high. As the DSG power increases this voltage support decreases and, in spite of the fact that the DSG is supplying more power, the load voltage decreases. The reactive support is shown in Figure 3-41 as a function of system voltage and input power.

As expected, the capacitive support is quite small for rated power from the DSG, and quite substantial for small power output.

The system power factor is shown in Figure 3-42.

The DSG power factor is, of course, excellent for rated power from the DSG, and poor for other, lower, values. System power factor depends on the system load. At heavy load the system power factor is fair until the DSG picks up a large amount of the real power - the system power factor then gets as low as about 0.6. With light load the system power factor is remarkably constant. This is because of a coincidence in the choice of load impedance and the amount of reactive compensation in this model. Other compensations yielded different results.

C-2

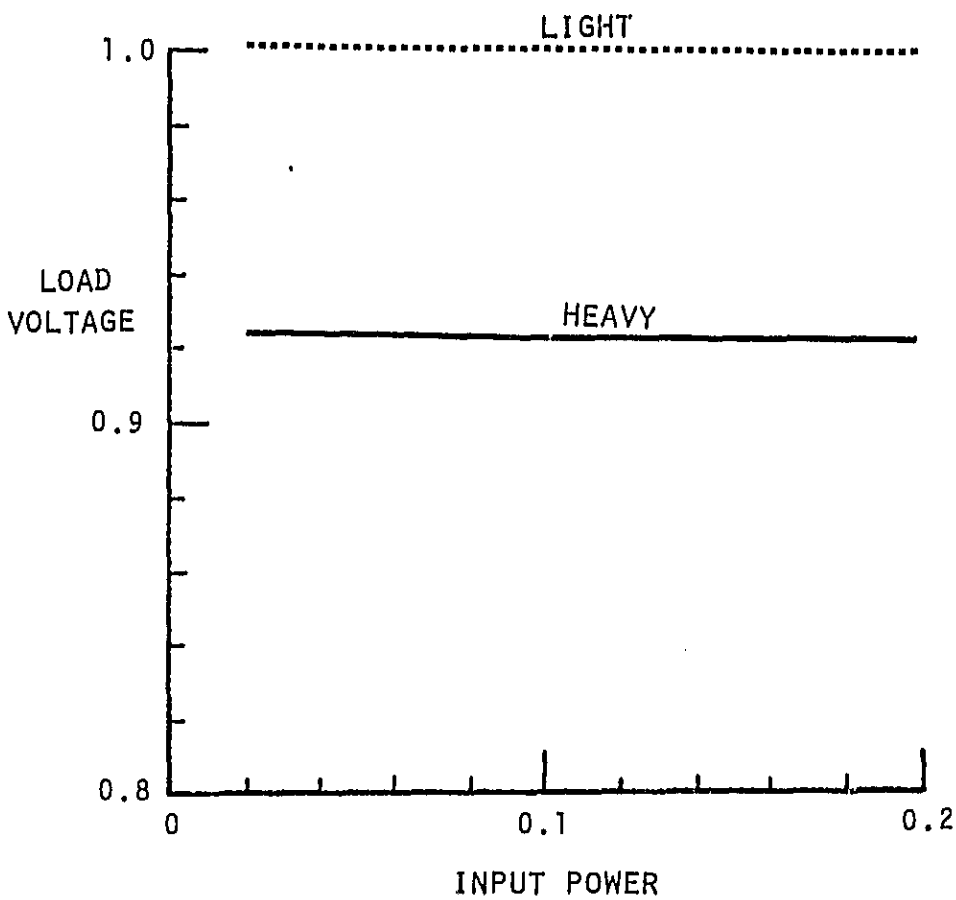

Figure 3-40. Load Voltage as a Function of Input Power, VS = 1 Compensated CEA Inverter

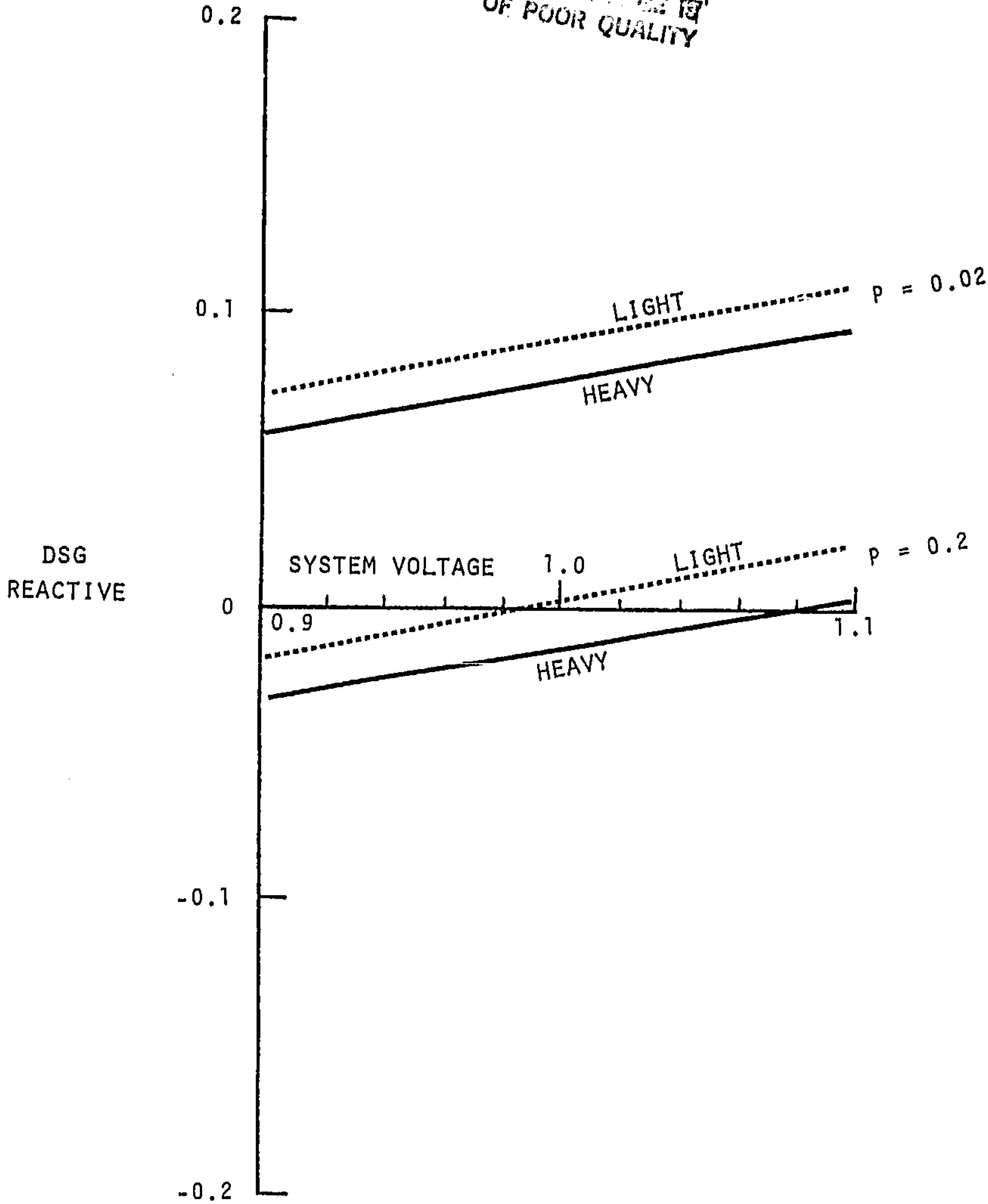

Figure 3-41. DSG Reactive Power as a Function of System Voltage, Compensated CEA Inverter

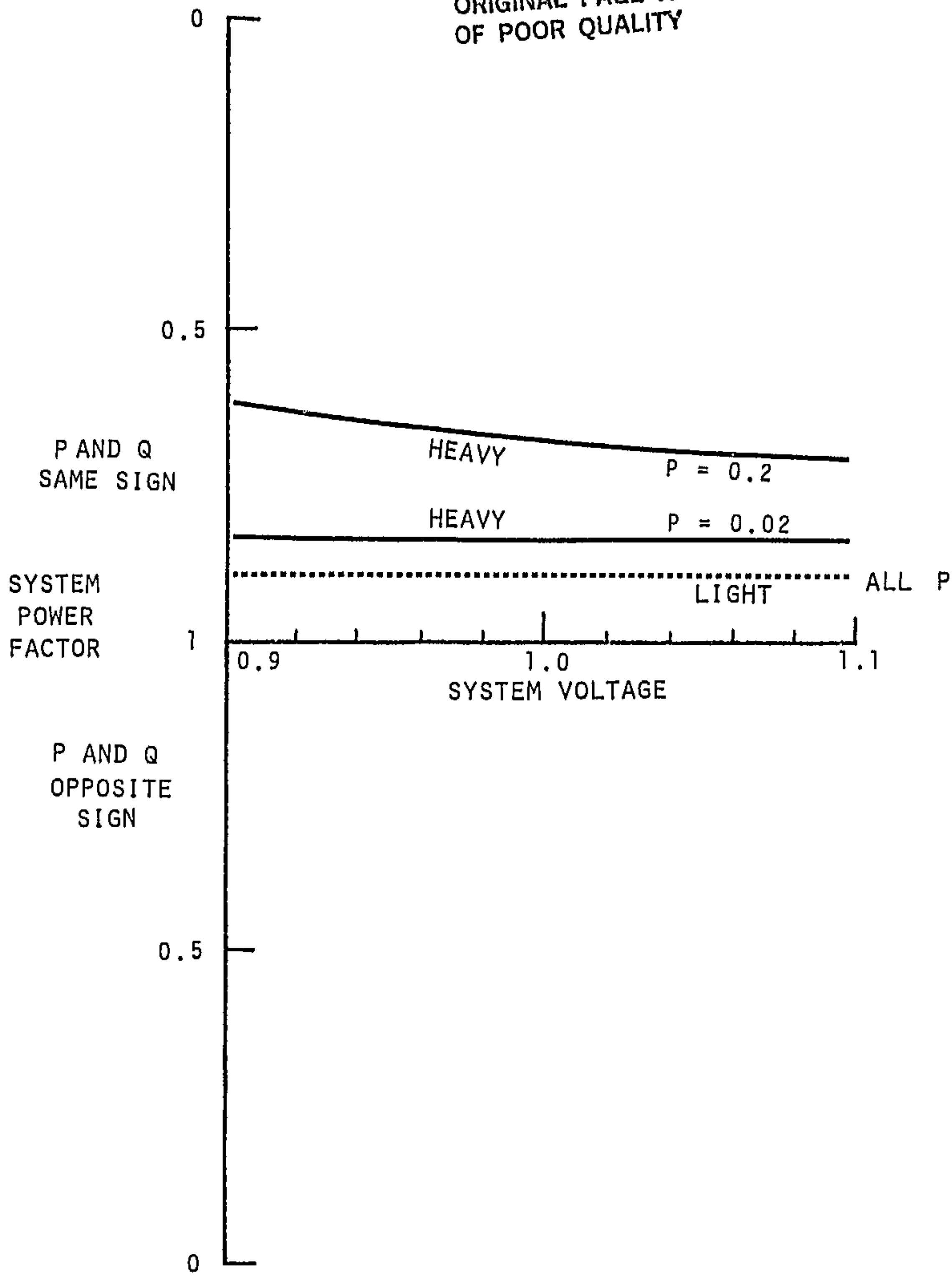

Figure 3-42. System Power Factor as a Function of System Voltage, Compensated CEA Inverter

Photovoltaic type Inverter

In this type of inverter, which is used with small photovoltaic arrays, the reactive power consumption is almost constant, increasing from 30% of the rated power at no (real power) output to 40% of the rated power at full load. This reactive power demand does not cause a problem in the load voltage as the power generated varies. This is shown in Figure 3-43.

There is nothing unusual about the way load voltage varies with system voltage, as shown in Figure 3-44.

As with the other inverters, the model used here is rather simple and cannot be used to show all the detail presented for the other DSGs. System power factor is shown in Figure 3-45. Machine efficiency cannot be examined through the model used here, but must be quite poor at low power. Since the input energy with this type of converter is likely to be solar (and therefore free), low efficiency at low power is not likely to be a deterrent to the use of the system.

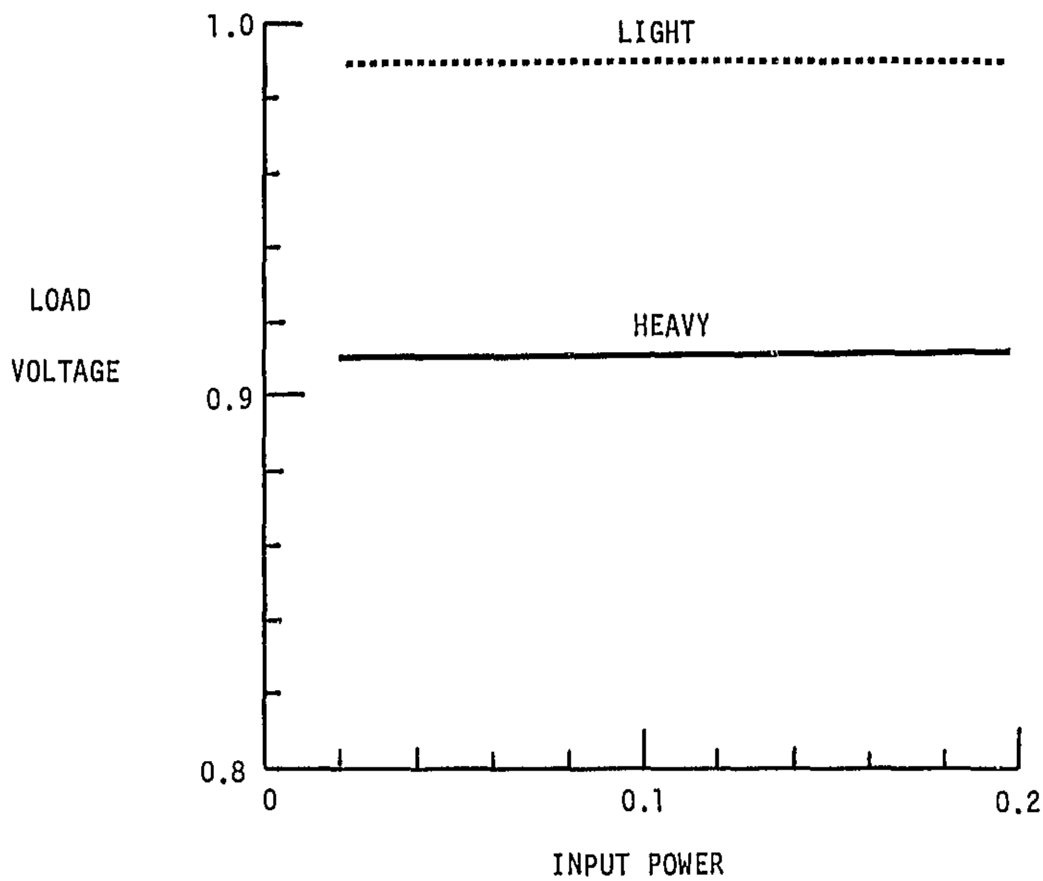

Figure 3-43. Load Voltage as a function of Input Power, VS=1
Photovoltaic type Inverter

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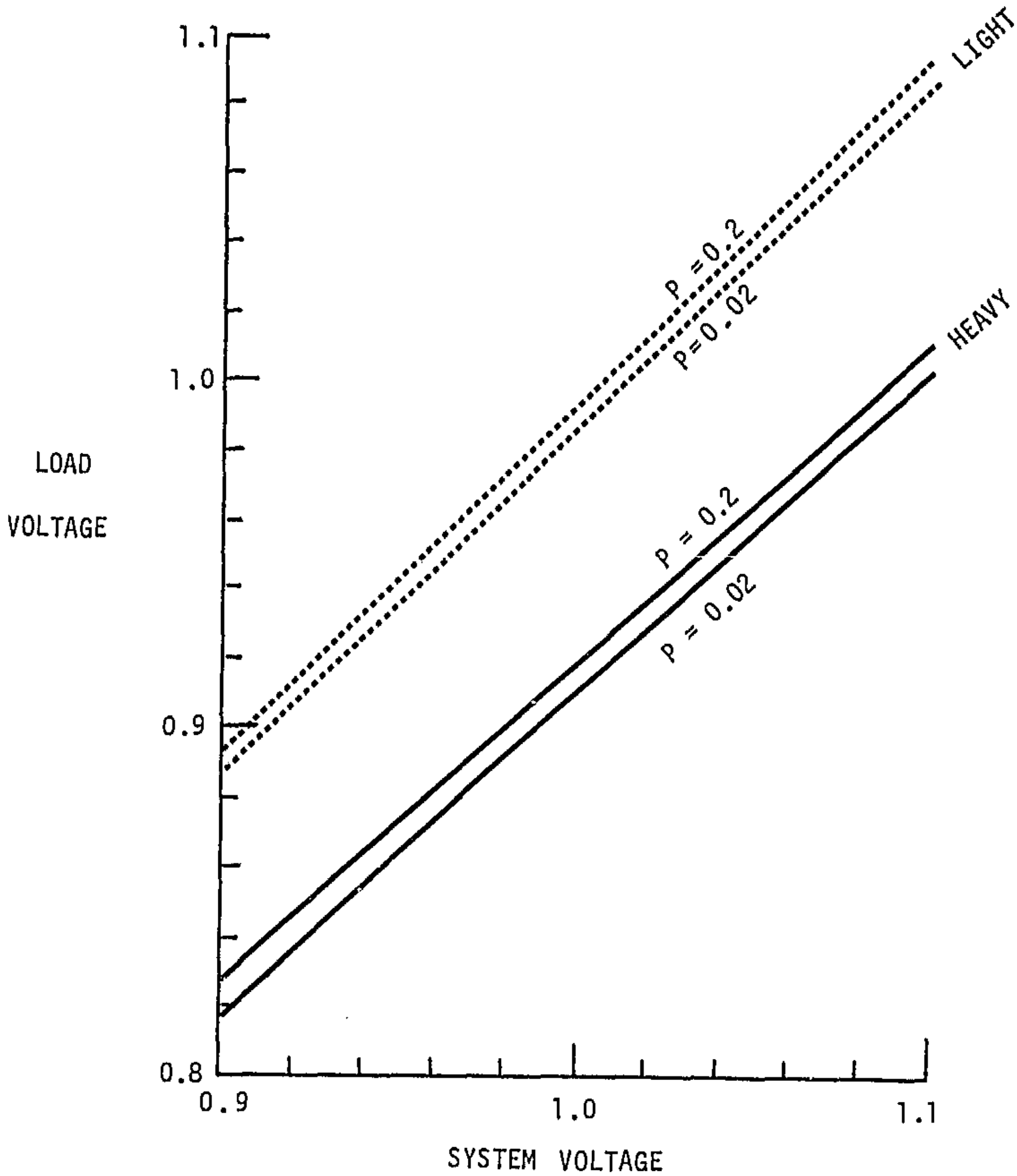

Figure 3-44. Load Voltage as a function of System Voltage, Photovoltaic type Inverter

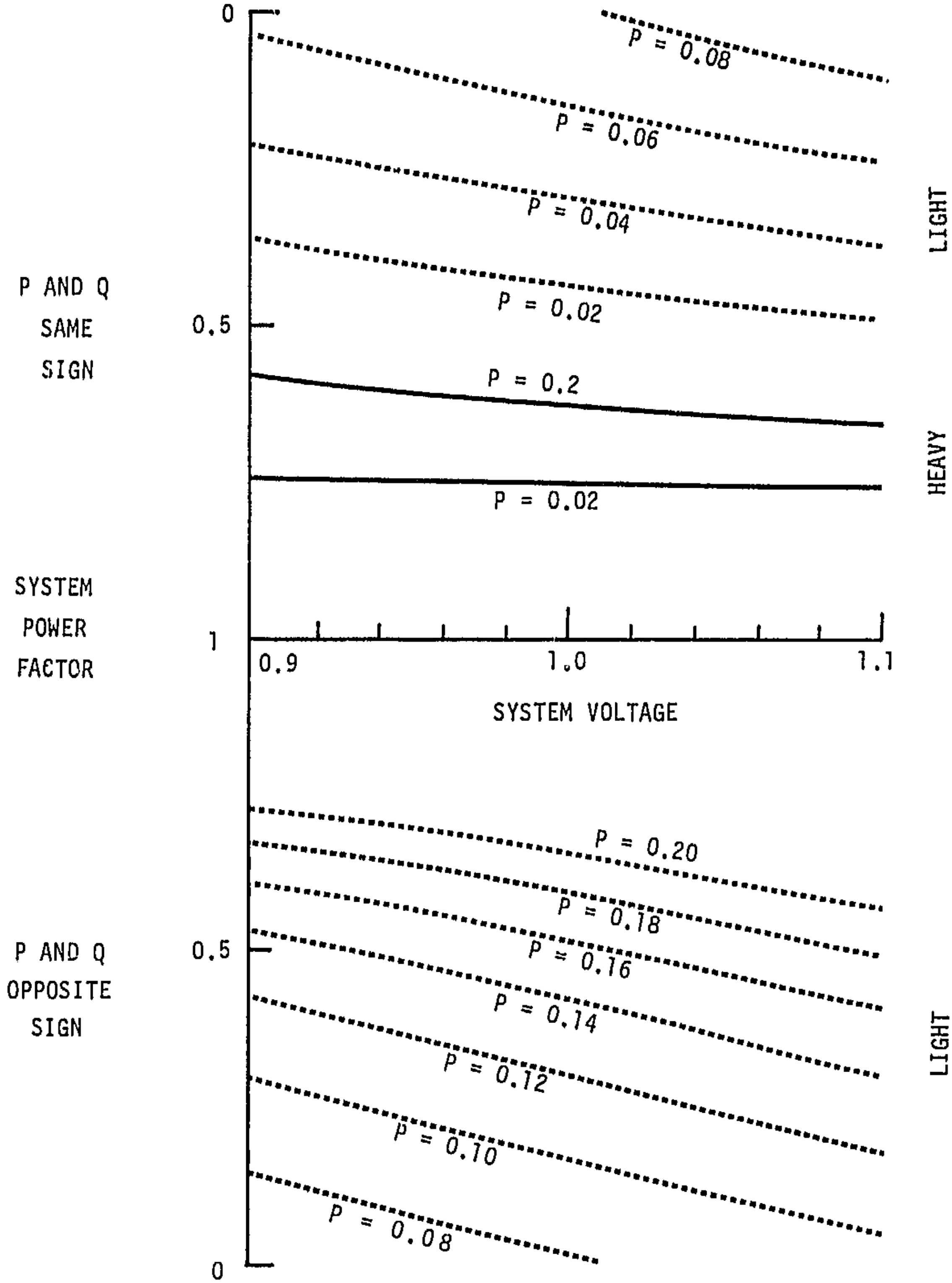

Figure 3-45. System Power Factor as a function of System Voltage, Photovoltaic type Inverter

Comparison of DSGs

The eight DSG types considered in this study evidently behave differently as far as voltage effects are concerned. Obviously, this is because of the different kinds of exciter control used, but it is difficult to see exactly what the differences will be if consideration is given only to the exciter equations. A better understanding of the reasons for the different voltage effects can be obtained by comparing the way in which the generation or consumption of reactive power varies.

Figure 3-46 shows the variation of reactive power for the eight DSG/exciter types studied, as a function of system voltage.

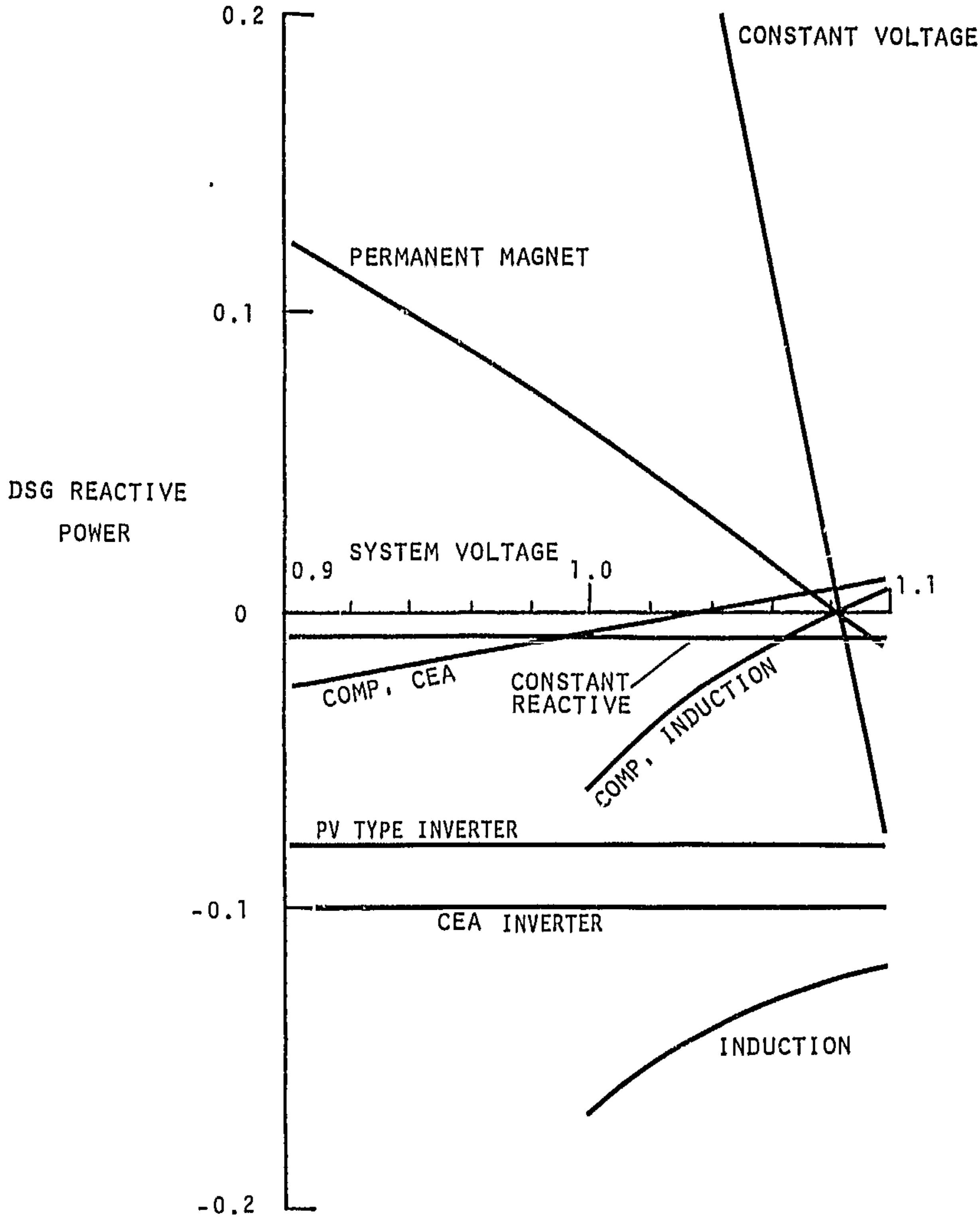

Figure 3-46. Reactive Power as a Function of System Voltage for the Eight DSG/Exciter Types Modelled. Input Power = 0.2 pu, Heavy Load.

As shown in Figure 3-46, there are basically three kinds of behavior as far as Q-variation with system voltage is concerned. The compensated CEA inverter type and the constant power factor synchronous machine generate or consume relatively little reactive power at their rated power output, and this reactive power does not vary strongly with system voltage.

The induction machine, the CEA inverter and the PV type inverter consume a moderately large amount of reactive power at rated output and, in the case of the induction machine, this power increases as the system voltage decreases. This is likely to cause a further decrease in terminal voltage, and could lead to voltage-induced instability.

The compensated induction machine is intermediate. It consumes relatively little power at full output, like the compensated CEA inverter, but its reactive demand increases considerably as the system voltage falls, like the induction machine.

The constant-voltage synchronous generator generates Q when the terminal voltage is below its set point, and consumes Q when the voltage rises above this point, in an effort to hold the voltage constant. As we have seen, the large reactive flow leads to considerable inefficiency in the machine.

The permanent magnet machine (constant excitation) is rather like a low-gain constant voltage machine, or it may be regarded as intermediate between the constant voltage and constant reactive machines.

Perhaps of equal concern is the variation of reactive power with real power. Figure 3-47 shows this for the eight DSG/exciter types.

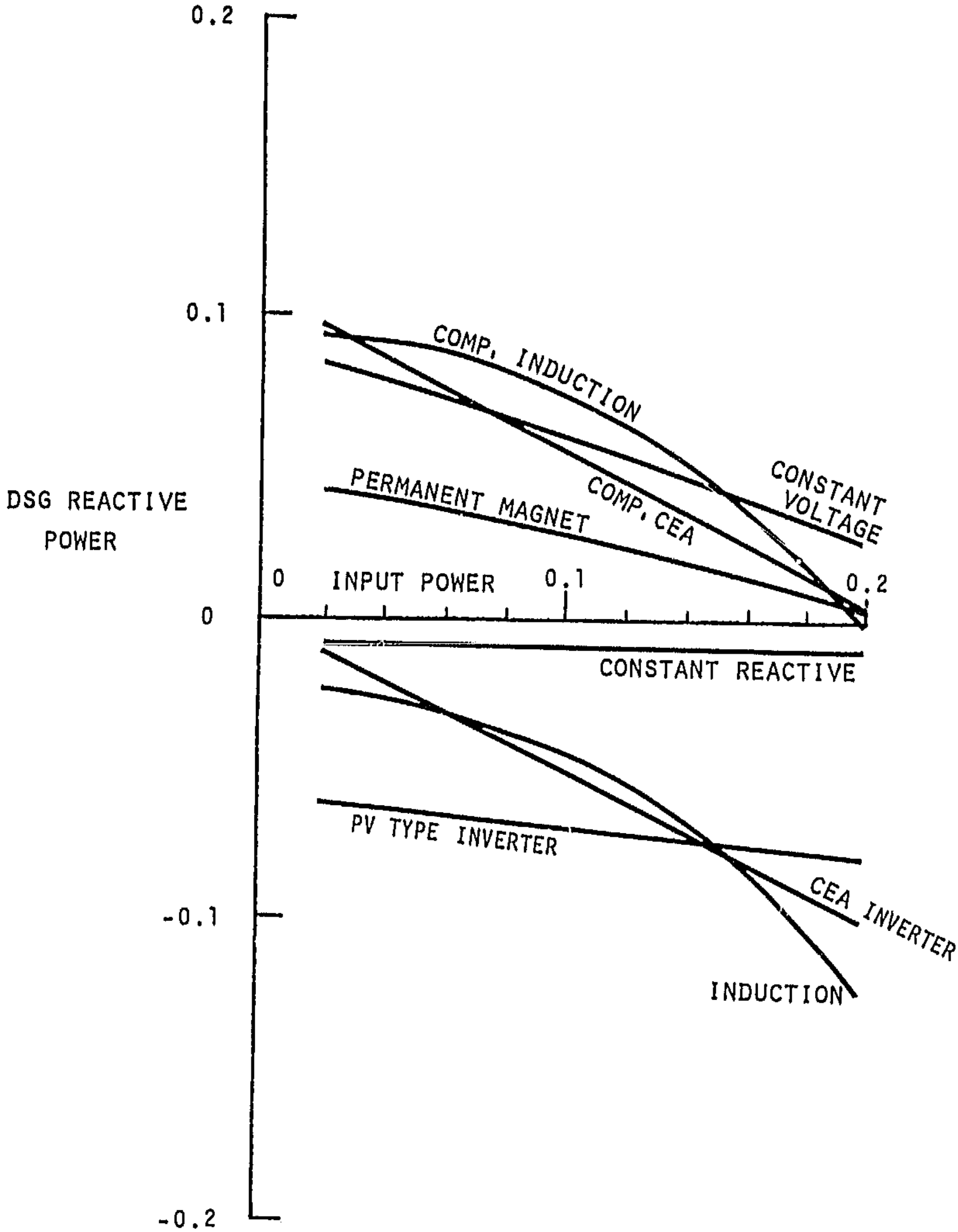

Figure 3-47. Reactive Power as a Function of Real Power for the Eight DSG/Exciter Types Modelled. VS = 1.08, Heavy Load

In Figure 3-47 the exciter types are more like one another, but with some differences still.

The constant-voltage synchronous machine, the compensated induction machine, the compensated CEA inverter and the permanent magnet type machine generate reactive power. The two compensated DSGs do so at low input power because they are over-compensated under these conditions. The constant voltage synchronous generator does so because the terminal voltage tends to drop as the DSG contribution to load power decreases.

The constant-Q controller naturally maintains very constant reactive demand. The CEA inverter, the PV type inverter and the induction machine both consume more reactive power as their real power input to the system is increased.

Again, the constant excitation synchronous machine is intermediate in performance, between the constant voltage and constant reactive machines.

The differences among the DSG/exciters can be seen in Table 3-1, which summarizes the information in Figures 3-46 and 3-47.

TABLE 3-1

COMPARISON OF DSG/EXCITER TYPES
CONSUMPTION OR GENERATION OF REACTIVE POWER

DSG/EXCITER	VARIATION WITH VOLTAGE		VARIATION WITH POWER	
	SLOPE[a]	INTERCEPT[b]	SLOPE[a]	INTERCEPT[b]
SYNCHRONOUS/CONSTANT VOLTAGE	LARGE, NEGATIVE	LARGE POSITIVE	NEGATIVE	POSITIVE
SYNCHRONOUS/CONSTANT REACTIVE	0	SMALL	0	SMALL NEGATIVE
SYNCHRONOUS/ CONSTANT EXCITATION	NEGATIVE	POSITIVE	NEGATIVE	POSITIVE
INDUCTION -	POSITIVE	LARGE NEGATIVE[c]	NEGATIVE	0[c]
INDUCTION (COMPENSATED)	POSITIVE	NEGATIVE[c]	NEGATIVE	POSITIVE
INVERTER/ CEA	0	NEGATIVE	NEGATIVE	0
INVERTER/ COMPENSATED CEA	VERY SMALL POSITIVE	SMALL	NEGATIVE	POSITIVE
INVERTER/ PV TYPE	0	NEGATIVE	NEGATIVE	NEGATIVE

a The slope of interest is the slope of the parameter in the range shown in Figures 3-46 and 3-47, i.e., 0.9 to 1.1 pu voltage and no-load to rated power for the DSG.

b The intercept of interest is the effective intercept in Figures 3-46 and 3-47, i.e., on the VS = 0.9 and PM = 0 axes.

c Approximated by a straight line.

Table 3-1 shows that no two DSG-exciter combinations are exactly alike. Most similar are the compensated CEA and the PV type inverter. Broadly speaking, systems which are similar with respect to voltage change are dissimilar as far as power is concerned, and vice versa.

Since the DSG/exciter combinations are all different in some respect, a logical question to ask is 'which one is best?' It may be easier to examine problems and disadvantages of various DSG/exciter combinations before proceeding with that question.

Problems and Disadvantages

The synchronous machine equipped with an exciter compounded for constant terminal voltage may be desirable from the power system point of view, but it results in an unacceptably large flow of reactive power in the DSG. As a result of this reactive power, the DSG efficiency is low and, if the DSG is privately owned, it may become economically unattractive.

It may be added here that if the utility wishes to do voltage control on the distribution system they would not employ a small generator or synchronous condenser to do it. Tap changing transformers, autotransformers, and capacitor banks are usually employed instead. Although there are many techniques for voltage control, none of which is a general standard, it may be noted that in most power systems large generator exciters are not usually employed to satisfy voltage constraints. It seems odd that such a use would be required of a DSG owner. In any event, aside from the question of machine efficiency, the fact that the machine excitation decreases as the system voltage increases means that the power transfer capability of the DSG is restricted at high system voltage, and this must be regarded as unacceptable.

This criticism of the controller does not apply in the case of the synchronous machine with a constant reactive power controller. This controller results in a relatively constant excitation, and there is no sign of a power limit being reached. The load voltage is more dependent on the system voltage than in the previous case (this is not a criticism), but still does not vary significantly with input power.

The constant excitation (permanent magnet) machine is evidently intermediate in performance between the constant voltage exciter and the constant reactive exciter. It is perhaps surprising that so simple an exciter could produce such a useful result. The DSG reactive power is positive at low voltage, and falls as the terminal volts rise (but not so rapidly as in the case of the constant voltage machine) and the reactive output falls with increasing power output (again not so rapidly as in the constant voltage machine).

The main criticism of this exciter is that the DSG power factor can be quite poor, resulting in decreased efficiency at low power and voltage.

The DSG power factor is, of course, always good, as a result of which the system power factor becomes very poor at light load. The situation is somewhat like the previous case in reverse - now there are times when the power system is absorbing power and supplying reactive power. This may be unacceptable to the utility if the DSG is privately owned, and the utility is paying for the input of power.

The induction generator consumes reactive power for its excitation all the time, and in large amounts at low system voltage. The large reactive consumption tends to further decrease the terminal voltage, which is exactly the opposite of what is required. This kind of DSG may be unacceptable from both the utility and the DSG-owner point of view. Its main advantage is simplicity - it is easy to start (without synchronizing, it could be started as a motor) and easy to operate (no control system for excitation).

The compensated induction machine suffers most of the disadvantages of the uncompensated generator, with the exception of its apparent power factor at full load. However, the machine still will not operate at high power and low voltage, and causes voltage variations as the input power changes.

The CEA inverter, like the induction machine, consumes more reactive power as its real power output increases. As a consequence, the system power factor is uniformly poor at light load, and not very good at heavy load.

In the case of the compensated CEA inverter, which is equivalent to a CEA inverter and a fixed power-factor correction capacitor, the system power factor is much improved at full load, and may be acceptable at light load. It should be noted that, as with some of the other DSGs at the point where the system power factor is at its worst, the actual amount of reactive power involved may be quite small. Thus, when the compensated CEA inverter real power output matches the load, in the light load case, the system power factor falls to zero. However, the reactive power is at this time being absorbed by the power system, and is less than 0.02pu.

The biggest criticism of the compensated CEA inverter is that it may lead to high-voltage conditions, and could also affect harmonics. Properly coordinated with the distribution system it could be a useful addition to the power system.

The PV type inverter, like the CEA inverter, consumes more reactive power as its real power output increases. As a consequence, the system power factor is uniformly poor at light load, and not very good at heavy load.

Connection

Up to this point in the evaluation of the various DSG voltage controllers one important parameter has not been considered, and that is the effect on the load voltage of merely connecting the DSG. Without the DSG the load voltage will be determined by the magnitude of the load and the system voltage. With the DSG connected the picture is much more complex. For the sake of comparison, it has been assumed that the DSGs are synchronized smoothly when their available power is 10% of their rating. It is then possible to recalculate the load voltage.

In the steady state (which is the condition computed) the load voltage may be higher or lower after the DSG has been connected than it was before the addition of the DSG, depending on the reactive power consumed or produced by the DSG. If the difference under the two circumstances is large, the addition of the DSG may cause objectionable lamp flicker, and result in voltage complaints (presumably from the neighbors). This voltage flicker is not caused by the generator dynamics.

It is assumed that the startup transient, if any, has died away. The exact nature of this transient will depend on the design of the DSG and the system. For many DSGs, particularly PV systems, the dynamic characteristics vary very widely, depending on inverter manufacturer and topology. Inclusion of transient effects would have made difficult our objective of providing results of general applicability. Our main interest is in the steady state effects in the absence of a communication system.

Small DSGs operating without a communication system may not be continually manned -- if the DSG is manned the question of voltage control may be moot in any case. Small automatic DSGs will presumably be programmed to operate as long as operation is profitable. In the case of PV, for example, the system should operate as soon as enough sun is available to overcome internal losses. If such a system were to come on- and off-line a few times a minute, perhaps because of cloud cover, any voltage changes might be particularly objectionable.

For this reason it is worthwhile to compare the various DSGs on a basis of the voltage change caused by the connection of the DSG at (an assumed reasonable starting power of) 10% of rated output. These results are shown in Table 3-2.

Table 3-3 compares the voltage changes which result from increasing the power from the 10% connection value to full rated output.

TABLE 3-2

PERCENTAGE LOAD VOLTAGE VARIATION DUE TO CONNECTING AT 10% RATED POWER

DSG/Exciter Type	System Voltage 1.08 Load		1.00 Load	
	Heavy	Light	Heavy	Light
Synchronous				
Constant Voltage	0.8	-3.7	4.0	0.7
Unity Power Factor	0.0	0.0	0.0	0.0
Constant Excitation	0.4	-0.2	2.0	0.5
Induction				
Uncompensated	-0.2	-0.2	-0.2	-0.2
Compensated	0.9	3.1	0.8	1.0
Inverter				
CEA	0.0	0.0	-0.1	0.0
Compensated CEA	0.9	1.1	0.8	1.0
PV type	-0.5	-0.5	-0.6	-0.5

TABLE 3-3

PERCENTAGE LOAD VOLTAGE VARIATION
DUE TO CHANGE IN INPUT POWER
FROM 0.02 TO 0.2 P.U.

DSG/Exciter Type	System Voltage 1.08 Load		1.00 Load	
	Heavy	Light	Heavy	Light
Synchronous				
Constant Voltage	0.2	0.1	0.3	0.1
Unity Power Factor	0.7	0.6	0.7	0.7
Constant Excitation	0.4	0.3	0.4	0.3
Induction				
Uncompensated	-0.2	-0.1	-0.7	-0.3
Compensated	-0.3	-0.1	-0.6	-0.2
Inverter				
CEA	-0.1	-0.1	-0.1	-0.1
Compensated CEA	-0.1	-0.1	-0.1	-0.1
PV type	0.6	0.5	0.6	0.5

Tables 3-2 and 3-3 show the impact on voltage for system voltages at 1.08 and 1.0. These values correspond to normal operation at heavy load and light load respectively. The value of 1.0 at heavy load may also be regarded as a representation of brownout conditions at heavy load.

The constant voltage exciter and the constant excitation machine show qualitatively similar behavior in Table 3-2. Both are attempting to maintain the terminal voltage. Thus, they both cause the voltage to increase when connected at heavy load, and they both cause the voltage to decrease when connected at light load with system voltage of 1.08. The unity power factor machine has no impact when connected, for any load and voltage combination.

The uncompensated induction machine causes a slight (0.2%) voltage droop when it is connected, but the compensating capacitor in the p.f. corrected version causes a voltage rise (of about 1%) when the induction machine is connected, because it is then overcorrected. The voltage rise is over 3% for high voltage light load conditions.

The PV type of dc/ac inverter causes a more or less uniform voltage droop when it is connected, the 'optimized' CEA inverter has practically no impact, and the capacitor compensated version causes about a 1% voltage rise.

It can be seen in Table 3-3 that a variation from practically no load to full load on the DSG usually results in only a very small change in the terminal voltage for each of these DSGs. The two worst DSGs are the unity power factor machine and the simplest PV inverter. In both these cases the reactive demand is almost constant as the power input changes.

Table 3-4 summarizes these discussions.

TABLE 3-4
COMPARISON OF DSG/EXCITERS

DSG/EXCITER	GOOD FEATURES	BAD FEATURES	COMMENTS*
SYNCHRONOUS/ CONSTANT VOLTAGE	STABILIZES LOAD VOLTAGE	LOW DSG EFFICIENCY MAY LIMIT POWER TRANSFER CAPABILITY	UNDESIRABLE TO DSG OWNER
CONSTANT Q (UNITY PF) SYNCH. OR INVERTER	MAXIMIZES DSG EFFICIENCY	SYSTEM POWER FACTOR POOR AT LIGHT LOAD	
SYNCHRONOUS/ CONSTANT EXCITATION	SIMPLE TO OPERATE HAS NO CONTROLLER	SYSTEM POWER FACTOR MAY BE POOR	POSSIBLE VOLTAGE JUMP AT START-UP.
INDUCTION MACHINE	SIMPLE TO OPERATE HAS NO CONTROLLER	SYSTEM POWER FACTOR POOR. LOW VOLTAGE CONDITION MAY BE AGGRAVATED BY DSG	UNDESIRABLE TO UTILITY MAY BE UNDESIRABLE TO DSG OWNER
INDUCTION MACHINE WITH COMPENSATION	SIMPLE TO OPERATE HAS NO CONTROLLER	COULD LEAD TO HARMONIC RESONANCE OR HIGH-VOLTAGE CONDITIONS	POSSIBLE VOLTAGE JUMP AT START-UP. COMPENSATION MAY BE COSTLY FOR DSG OWNER
INVERTER/ CEA CONTROL	SIMPLE, PROVEN DESIGN	SYSTEM POWER FACTOR POOR	
INVERTER - CEA CONTROL WITH COMPENSATION	SIMPLE, PROVEN DESIGN	COULD LEAD TO HARMONIC RESONANCE OR HIGH-VOLTAGE CONDITIONS	POSSIBLE VOLTAGE JUMP AT START-UP. COMPENSATION MAY BE COSTLY FOR DSG OWNER
INVERTER - PV TYPE	SIMPLE AND CHEAP	SYSTEM POWER FACTOR MAY BE POOR	VOLTAGE DIP AT START-UP. VOLTAGE VARIES WITH POWER

*Whether or not a particular DSG/exciter type is acceptable to a utility or to the owner of the DSG depends upon many factors. It is assumed in this table that the utility and DSG owner are separate entities, that the DSG owner is to be paid only for real power, and that the utility does not wish to change its operating policies.

Table 3-4 suggests that none of the DSG/exciter types studied would be universally acceptable. Among the best may be the constant Q (unity p.f.) generators (whether self-commutated inverter or synchronous machine) which can only be criticized for leaving the load reactive demand constant as it reduces the real power load on the power system, and the CEA type inverter. which has practically no impact on the load voltage, either as it is connected or as the input power varies. This results in a poor power factor on the power system and, in the case of separate DSG ownership, could result in the utility's 'paying for the privilege of supplying reactive power'.

On the other hand, many utilities experience high-voltage problems at night, when the light load on the system (and its lines) results in a surplus of reactive generation. If this is the case, this kind of DSG may be quite acceptable.

On the basis of voltage variations alone, the CEA type inverter has the least impact on the load voltage of all the types considered.

Proposed New Exciter Control

While all the DSG types studied behave differently in terms of their real:reactive power ratios, as in Figure 3-47, they all have one thing in common. The reactive power generation either decreases or is constant as real power output increases. None of the DSGs succeeds in generating reactive power in proportion to its real power generation.

This singular omission was rectified by a modification of the constant Q program. Results are given in Appendix C, which also includes the program listing and description. The control system was modelled to have no loop error for a leading power factor of 0.8. Operation of the generator was then at approximately 0.83 p.f. (leading), the power factor improving somewhat at low values of output power.

As in the other presentations. we begin with the graph of load voltage against input power, Figure 3-48. Unlike most of the other graphs, this one shows a distinct increase in the load voltage with input power for both heavy and light loads. The reason is clearly that as the input power increases so does the amount of reactive power which is removed from the system.

Figure 3-49 shows the excitation voltage varying with system voltage. Again, the values are not unusual. increasing only slightly as the system voltage increases.

Figure 3-50 shows the load voltage as a function of system voltage. In this case the load voltage is more dependent on the input power than in some of the other cases, but its dependence on system voltage, as shown here. is no worse than without the DSG.

Figure 3-51 shows the DSG power as a function of system voltage. The DSG is quite reasonably efficient, independent of the value of system voltage. This is to be expected since the power factor is uniformly quite good.

It is not worthwhile to show the variation in DSG reactive power as a function of real power for this machine since the assumption behind the exciter control system is that the power factor is constant at 0.8 leading. For the same reason the system reactive power is not shown, nor is the power factor of the system or the DSG.

In view of the poor voltage regulation with this version of the DSG (it is in this regard the worst of all the DSGs modelled), it is extremely difficult to see why more effort should be expended on its development. The program and data are given in Appendix C.

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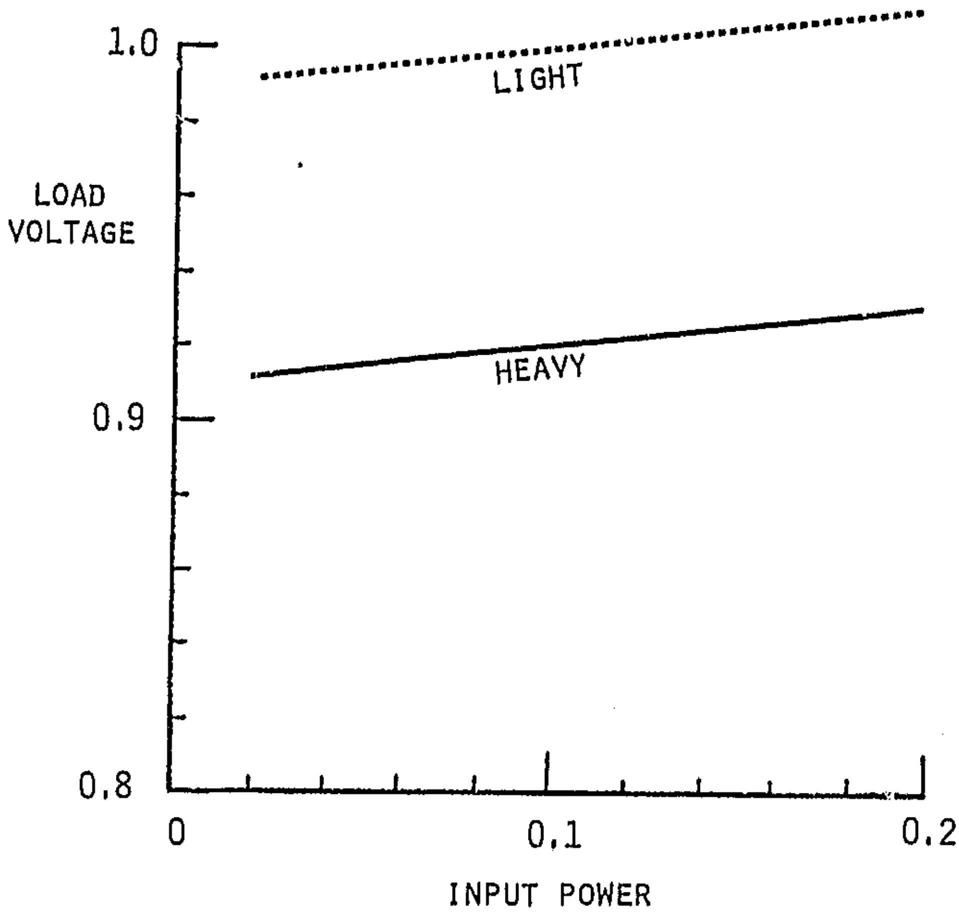

Figure 3-48. Load Voltage as a Function of Input Power, VS = 1
Leading Power Factor Machine

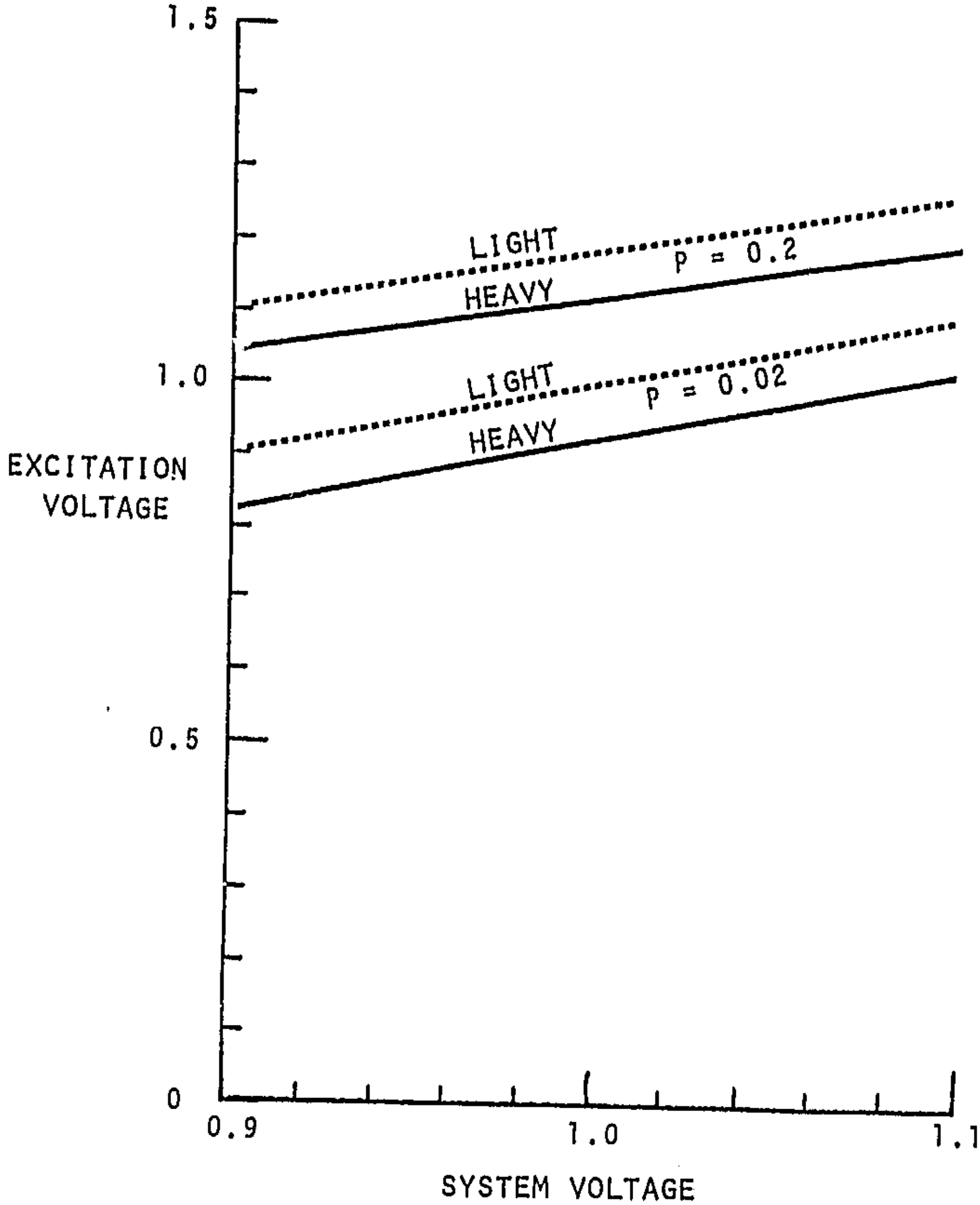

Figure 3-49. Excitation as a Function of System Voltage
Leading Power Factor Machine

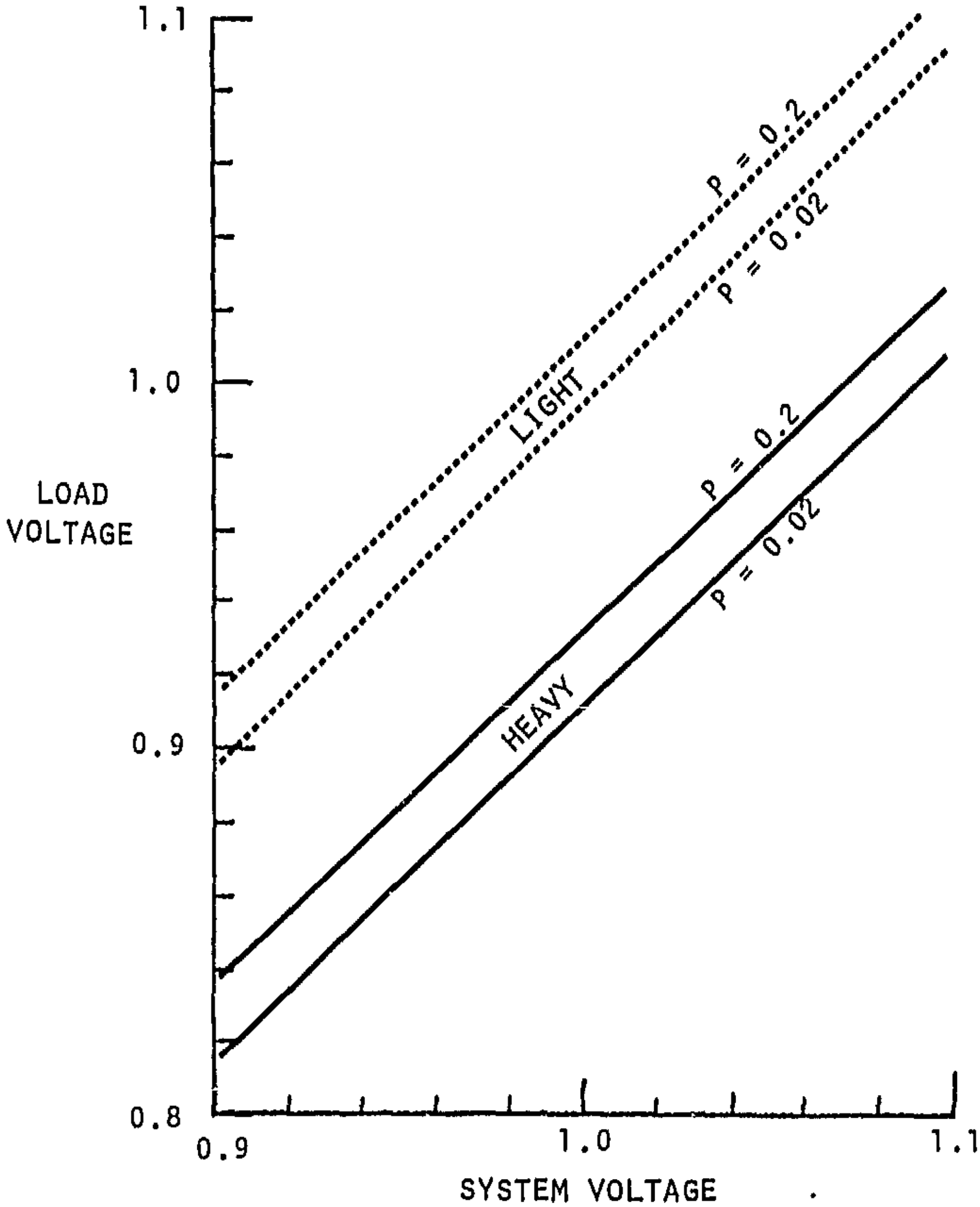

Figure 3-50. Load Voltage as a Function of System Voltage Leading Power Factor Machine

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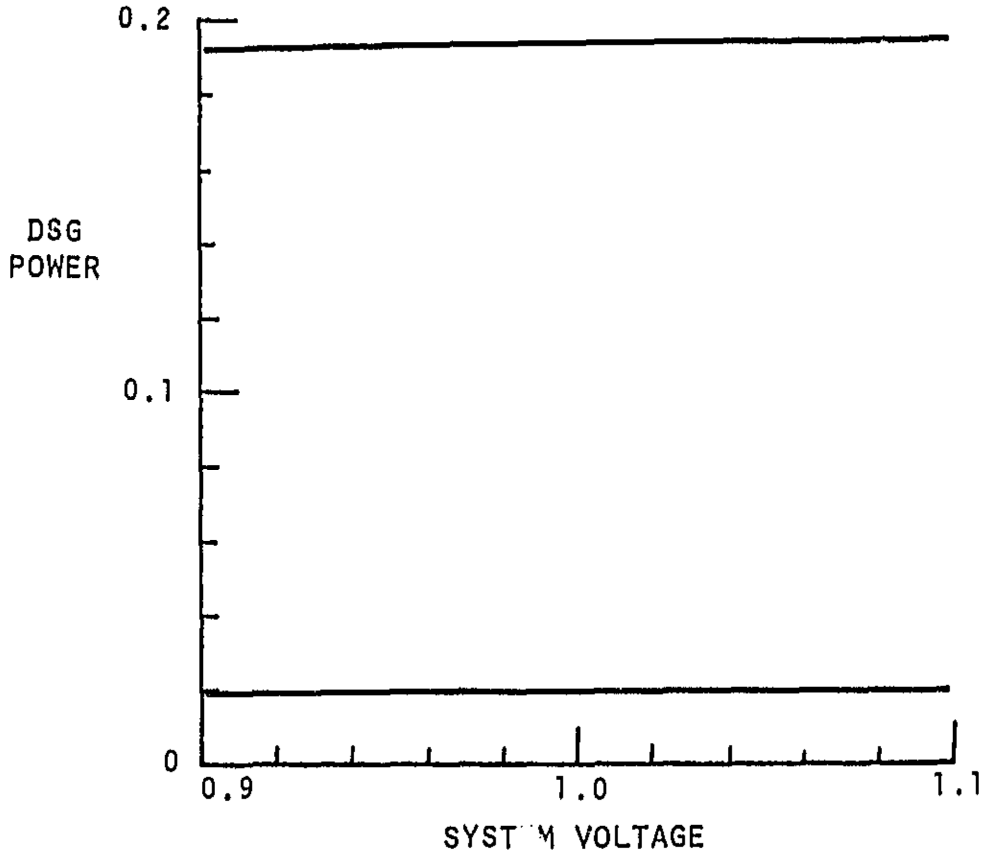

Figure 3-51. DSG Power as a Function of System Voltage
Leading Power Factor Machine

SECTION 4

CONCLUSIONS

Eight different kinds of DSG/exciter combination have been studied. They were:

1. Synchronous machine with a constant voltage exciter.
2. Synchronous machine with a unity power factor exciter.
3. Synchronous machine with a constant excitation exciter.
4. Induction machine.
5. Induction machine with power factor correcting capacitor.
6. Constant extinction angle inverter with tap-changer.
7. Constant extinction angle inverter with tap-changer and power factor correcting capacitor.
8. PV type inverter.

Many of these DSG/exciter combinations have shortcomings which mean that their application to the distribution system should be regarded with some care by either the owner or the utility.

In this study, the effect of uncertainties in prime mover power was modelled by varying the input power to the DSG model. It may be possible to regard this variation in power as representative also of varying penetrations of DSGs, bearing in mind that such an extension of the original purpose of varying the input power might sometimes be misleading. It may be observed that for heavy load, maximum penetration is 20%, whereas for light load more than 100% penetration is effectively achieved. In fact, at light load, 100% penetration is achieved when the input power is 0.08 pu.

Problems on the power system caused by poor power factor or large relative reactive power consumption at light load may not be serious because, at light load, the power system components are (by definition) not particularly stressed. However, if we take the light load conditions as being representative of some future high penetration situation, then the system power factor becomes of more interest.

In Section Three the system power factor behavior at light load was shown to fall into basically two categories. In Figure 3-7 for the constant voltage exciter and Figure 3-18 for the constant excitation machine, the system power factor at light load was shown to go through violent excursions at approximately one per unit voltage. This arises because the DSG is essentially trying to maintain the terminal voltage constant, independent of the power system to which it is connected. If the utility were attempting to reduce voltage, perhaps as a Commission-directed conservation measure, DSGs of this type would essentially be fighting the power system.

All of the other DSGs resulted in a system power factor which was more or less independent of the system voltage.

At low penetration, heavy load, none of the DSGs had a particularly adverse effect on the system power factor or the terminal voltage after they were connected. There would seem to be no reason for any utility to prohibit or limit the use of any of these DSGs on those grounds. On the other hand, the independent DSG owner may be reluctant to suffer the losses involved in the constant voltage machine or to pay for the compensation that may be required on the induction machine or the CEA inverter.

Some of the DSGs did cause a noticeable change in voltage as they were connected. Connection was assumed to take place at 10% of the DSG rated power, which amounts to only 2% of the system rating, so it is clear that any voltage effects observed must be due to reactive power. Voltage increases were seen for the capacitor compensated DSGs (because they were over compensated at 10% power) and decreases were seen for the DSGs which consume reactive power at light load.

The DSG which had the least impact on voltage, either as it was connected or when its input power varied, was the optimized CEA inverter, which was modelled to have constant (lagging) power factor.

The reason that this performed so well as far as terminal voltage is concerned is clear. As it is synchronized at low power, it consumes or generates only a small amount of reactive power. As the power output increases, which might cause a rise in voltage, the reactive demand increases and compensates for this effect.

The power factor in this case was between 0.8 and 0.9 lagging. It seems likely that the value of power factor at which the load voltage will change least will depend on the load (whose power factor will itself change with DSG penetration level) and the system impedance. Nonetheless, it is interesting that this is bound to be a lagging power factor.

In this study we have neglected transient effects, such as current inrush into the induction machines. Consideration of such transients would have further complicated an already involved situation. It must be acknowledged, however, that many kinds of DSG can cause start-up transients, and these also must be limited.

It is our feeling that any DSG which draws little reactive power as it is synchronized and operates at a slightly lagging power factor will have minimum impact on load voltage, and could operate without system-coordinated voltage control.

SECTION 5

REFERENCES

1-1 O. I. Elgerd, Electric Energy Systems Theory: An Introduction, (McGraw-Hill, 1971).

2-1 Electric Utility Engineering Reference Book - Distribution System, Westinghouse Electric Corporation, 1965.

2-2 G. R. Slemon and A. Straughen, Electric Machines, (Addison-Wesley Publishing Company, 1980).

2-3 C. Beeriger, 'Reactive Load at HVDC Terminals', Brown Boveri, Rev. 2/3-73, pp 95.

APPENDIX A

PROGRAM LISTINGS

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TABLE A-I

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE

```
10 REM VOLTAGE STUDY        FILE B:SYNC
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE CASE OF A SYNCHRONOUS GENERATOR"
40 REM
50 REM INITIALIZE
60 REM
70 REM SET THE VALUES OF THE VARIOUS PARAMETERS IN THE SYSTEM
80 REM
90 REM
100 RS      = .04
110 XS     = .1
120 R1=.1
130 X1=1
140 KG=10
150 VREF=1.104
160 VLIMIT  = 2.5
170 KV=-.4
180 KD = -10
190 REM
200 REM   SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
210 REM
220 FOR LTYPE = 1 TO 2 STEP 1
230 IF(LTYPE=1) GOTO 270
240 LPRINT
250 LPRINT "REALISTIC LOAD REPRESENTATION"
260 GOTO 330
270 LPRINT "CONSTANT IMPEDANCE LOAD"
280 REM
290 REM SET THE INPUT POWER
300 REM IN THIS PROGRAM THIS IS THE OUTER LOOP
310 REM NOT COUNTING THE LTYPE CHANGES AS A LOOP
320 REM
330 FOR PG = .02 TO .2 STEP .02
340 LPRINT
350 LPRINT
360 LPRINT "SYS V   P IN   DSG P   DSG Q  DSG PF   SYS P   SYS Q   SYS PF  LOA
V  EXCITN"
370 VT   = .88
380 REM
390 REM SET THE SYSTEM VOLTAGE
400 REM THIS IS THE MAIN INNER LOOP
410 REM
420 FOR VS = .9 TO 1.1 STEP .02
430 DELTA = 45
440 VITER = 0
450 DITER = 0
460 REM
470 REM  START HERE WITH INTERNAL ITERATION LOOP FINDING ANGLE
480 REM THIS IS THE FIRST LOOP USED IN THE SOLUTION
490 REM
500 DITER = DITER +1
```

TABLE A-I, cont.

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE

```
510 VITER = VITER +1
520 V1        = KG*(VREF-VT)
530 IF(V1<=0) GOTO 1660
540 IF(V1<=VLIMIT) GOTO 570
550 PRINT "OVER EXCITATION"
560 V1   = VLIMIT
570 V1R       = V1*COS(DELTA*3.1416/180)
580 V1I      = V1*SIN(DELTA*3.14159/180)
590 A        = V1R-VT
600 B        = V1I
610 C        = R1
620 D        = X1
630 GOSUB 1690
640 I1R       = DIVR
650 I1I       = DIVI
660 REM
670 REM       GOT CURRENT, NOW FIND THE POWER
680 REM
690 A       = V1R
700 B       = V1I
710 C       = I1R
720 D       = -I1I
730 GOSUB 1690
740 INPWR = PRODR
750 REM THE NEXT LINE IS A DIAGNOSTIC USED IN PROGRAM DEVELOPMENT
760 REM PRINT "CALCULATED INPUT POWER IS ";INPWR;" AND PG IS ";PG
770 PWRERR= INPWR - PG
780 IF(ABS(PWRERR)<.001)GOTO 930
790 DELTA      = DELTA + KD*PWRERR
800 IF DELTA < 90 GOTO 850
810 REM THE NEXT LINE IS A DIAGNOSTIC
820 PRINT "DELTA EXCEEDS STEADY STATE LIMIT, CASE TERMINATED"
830 GOTO 1610
840 REM THE NEXT LINE IS A DIAGNOSTIC USED IN PROGRAM DEVELOPMENT
850 REM PRINT "DELTA = ";DELTA;"AND EXCITATION IS ";V1;"AT ITERATION ";DITER
860 GOTO 500
870 REM
880 REM FALL THROUGH HERE WHEN THE DELTA IS CORRECT
890 REM THIS IS THE END OF THE FIRST SOLUTION LOOP
900 REM OR THE START OF THE SECOND SOLUTION LOOP
910 REM
920 REM THE NEXT LINE IS A DIAGNOSTIC USED IN PROGRAM DEVELOPMENT
930 REM PRINT "DELTA ITERATED ";DITER;" TIMES"
940 REM
950 REM NOW ITS TIME TO FIND THE VOLTAGE CONDITIONS
960 REM
970 REM FIRST FIND I2 BY ADDING I1 AND IL
980 REM     CALCULATE IL
990 REM   CHECK THE LOAD TYPE
1000 REM
1010 IF (LTYPE = 1) GOTO 1040
1020 N     = 1.3
1030 GOTO 1050
1040 N     = 2
```

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE


```
1050 ILR   =.08*(VT^(N-1))
1060 ILI   =-.06*(VT^(N-1))
1070 REM    WITH IL AND I1 FIND I2
1080 I2R   = ILR - I1R
1090 I2I   = ILI - I1I
1100 REM
1110 REM NOW FIND THE ZS DROP
1120 REM
1130 A     = I2R
1140 B     = I2I
1150 C     = RS
1160 D     = XS
1170 GOSUB 1690
1180 ZSDRR= PRODR
1190 ZSDRI= PRODI
1200 REM
1210 REM NOW WE GOT THE VALUE OF VS:
1220 REM
1230 VSR   = VT + ZSDRR
1240 VSI   = +ZSDRI
1250 MAGVS= SQR(VSR^2 + VSI^2)
1260 REM
1270 REM COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
1280 REM
1290 VERR = MAGVS - VS
1300 IF(ABS(VERR)<.001)GOTO 1370
1310 VT    = VT + KV*VERR
1320 REM THE NEXT LINE IS A DIAGNOSTIC USED IN PROGRAM DEVELOPMENT
1330 REM PRINT "TERMINAL VOLTS ";VT;" AT VOLTAGE ITERATION ";VITER
1340 GOTO 450
1350 REM
1360 REM FALL THROUGH HERE WHEN VOLTAGE CONDITIONS ARE CORRECT
1370 REM  TIME TO CALCULATE ALL THE VALUES NEEDED FOR THE PRINTOUT
1380 REM
1390 REM  FIRST THE DSG PARAMETERS
1400 REM
1410 A     = VT
1420 B     = 0
1430 C     = I1R
1440 D     = -I1I
1450 GOSUB 1690
1460 DSGP = PRODR
1470 DSGQ = PRODI
1480 DSGPF = COS(ATN(DSGQ/DSGP))
1490 REM
1500 REM    NOW FOR THE SYSTEM PARAMETERS
1510 A     = VT
1520 B     = 0
1530 C     = I2R
1540 D     = -I2I
```

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE


```
1550 GOSUB 1690
1560 SYSP = PRODR
1570 SYSQ = PRODI
1580 SYSPF   = COS(ATN(SYSQ/SYSP))
1590 LPRINT USING "#.##    ";VS;
1600 LPRINT USING "#.###    ";PG;DSGP;DSGQ;DSGPF;SYSP;SYSQ;SYSPF;VT;V1
1610 NEXT VS
1620 VT    = .88
1630 NEXT PG
1640 NEXT LTYPE
1650 STOP
1660 PRINT "NO EXCITATION, CASE TERMINATED"
1670 GOTO 1610
1680 REM
1690 REM    SUBROUTINE TO FIND COMPLEX PRODUCTS AND DO COMPLEX DIVISIONS
1700 PRODR = A * C - B * D
1710 PRODI = B * C + A * D
1720 DEN   = C*C +D*D
1730 DIVFLG = 0
1740 IF (DEN=0)GOTO 1780
1750 DIVR  = (A*C + B*D)/DEN
1760 DIVI  = (B*C - A*D)/DEN
1770 RETURN
1780 DIVFLG = 1
1790 REM CHECK DIVFLG ON DIVISIONS BY VARIABLES ONLY
1800 RETURN
```



```
10 REM KIRKHAM'S FAMOUS VOLTAGE STUDY        FILE B:CONREACT
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE CASE OF A SYNCHRONOUS GENERATOR"
40 LPRINT "                  CONSTANT POWER FACTOR CONTROL"
50 REM
60 REM INITIALIZE
70 REM
80 RS      = .04
90 XS     = .1
100 R1=.1
110 X1=1
120 KG  = 100
130 QREF   = 0
140 VLIMIT  = 2.5
150 KV  = -.0004
160 KB = - 3
170 REM   SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
180 FOR LTYPE = 1 TO 2 STEP 1
190 IF(LTYPE=1) GOTO 230
200 LPRINT
210 LPRINT "REALISTIC LOAD REPRESENTATION"
220 GOTO 250
230 LPRINT "CONSTANT IMPEDANCE LOAD"
240 REM SET THE INPUT POWER
250 FOR PG = .02 TO .2 STEP .02
260 LPRINT
270 LPRINT
280 LPRINT "SYS V   P IN   DSG P   DSG Q  DSG PF   SYS P   SYS Q   SYS PF  LOA
V  EXCITN"
290 REM GUESS THE VALUE OF VT
300 VT  = .86
310 REM GUESS THE ANGLE OF VS...CALL IT BETA
320 BETA  = 1.447
330 REM SET THE SYSTEM VOLTAGE
340 FOR VS = .9 TO 1.1 STEP .02
350 VITER = 0
360 DITER = 0
370 DITER = DITER +1
380 VITER = VITER +1
390 REM    CALCULATE IL
400 REM   CHECK THE LOAD TYPE
410 IF (LTYPE = 1) GOTO 440
420 N     = 1.3
430 GOTO 450
440 N     = 2
450 ILR  = .8*(VT^(N-1))
460 ILI  = -.6*(VT^(N-1))
470 REM WITH IL, VS AND BETA FIND I2
480 VSR   = VS*COS(BETA*3.14159/180)
490 VSI   = VS*SIN(BETA*3.14159/180)
```

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE


```
500 A      = VSR-VT
510 B      = VSI
520 C      = RS
530 D      = XS
540 GOSUB 1330
550 I2R    = DIVR
560 I2I    = DIVI
570 REM
580 REM NOW FIND I1
590 REM
600 I1R    = ILR - I2R
610 I1I    = ILI - I2I
620 REM NOW WE GOT A VALUE FOR I1, CALCULATE THE VALUE OF V1
630 A      = I1R
640 B      = I1I
650 C      = R1
660 D      = X1
670 GOSUB 1330
680 Z1DRR = PRODR
690 Z1DRI = PRODI
700 V1R    = VT + Z1DRR
710 V1I    = Z1DRI
720 REM
730 REM NOW WE GOT THE VALUE OF V1:
740 REM
750 MAGV1= SQR(V1R^2 + V1I^2)
760 REM
770 REM COMPARE THE CALCULATED VALUE OF DSGQ WITH THE VALUE NEEDED ACCORDING TO
 THE CONTROLLER EQUATION, AND CORRECT IF NEEDED
780 REM
790 A     = VT
800 B     = 0
810 C     = I1R
820 D     = -I1I
830 GOSUB 1330
840 DSGP = PRODR
850 DSGQ = PRODI
860 PRINT DSGQ,MAGV1
870 PRINT "TERMINAL VOLTS ";VT;" AT VOLTAGE ITERATION ";VITER
880 REM  USE THE CONTROLLER EQUATION
890 V1    = KG*(QREF-DSGQ)
900 REM PRINT "LINE 885     V1 FROM Q IS ";V1
910 VERR = MAGV1 - V1
920 PRINT "LINE 920   VERR IS ";VERR
930 IF ABS(VERR)<.001 GOTO 980
940 VT    = VT + KV*VERR
945 PRINT "LINE 945        UPDATED VT IS ";VT
950 GOTO 360
960 REM
970 REM FALL THROUGH HERE WHEN VOLTAGE CONDITIONS ARE CORRECT
980 REM  TIME TO CALCULATE THE POWER BALANCE
990 PRINT "STARTING POWER BALANCE"
```

TABLE A-II, cont.

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE


```
1000 A     = V1R
1010 B     = V1I
1020 C     = I1R
1030 D     = -I1I
1040 GOSUB 1330
1050 PIN   = PRODR
1060 PERR = PG - PIN
1070 PRINT "LINE 1070     PERR IS ";PERR
1080 IF ABS(PERR)<.0001 GOTO 1130
1090 BETA = BETA + KB*PERR
1100 GOTO 370
1110 REM  FIRST THE DSG POWER FACTOR
1120 REM
1130 DSGPF = COS(ATN(DSGQ/DSGP))
1140 PRINT "LINE 1140     BETA IS ";BETA
1150 REM
1160 REM     NOW FOR THE SYSTEM PARAMETERS
1170 A     = VT
1180 B     = 0
1190 C     = I2R
1200 D     = -I2I
1210 GOSUB 1330
1220 SYSP = PRODR
1230 SYSQ = PRODI
1240 SYSPF    = COS(ATN(SYSQ/SYSP))
1250 LPRINT USING "#.###    ";VS;
1260 LPRINT USING "#.###    ";PG;DSGP;DSGQ;DSGPF;SYSP;SYSQ;SYSPF;VT;V1
1270 NEXT VS
1280 VT    = .86
1290 NEXT PG
1300 NEXT LTYPE
1310 STOP
1320 REM
1330 REM     SUBROUTINE TO FIND COMPLEX PRODUCTS AND DO COMPLEX DIVISIONS
1340 PRODR = A * C - B * D
1350 PRODI = B * C + A * D
1360 DEN    = C*C +D*D
1370 DIVFLG = 0
1380 IF (DEN=0)GOTO 1420
1390 DIVR   = (A*C + B*D)/DEN
1400 DIVI   = (B*C - A*D)/DEN
1410 RETURN
1420 DIVFLG = 1
1430 REM CHECK DIVFLG ON DIVISIONS BY VARIABLES ONLY
1440 RETURN
```

TABLE A-III

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION

```
10 REM  FAMOUS VOLTAGE STUDY        FILE B:PMAG
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE CASE OF A SYNCHRONOUS GENERATOR"
40 REM
50 REM INITIALIZE
60 REM
70 RS      = .04
80 XS     = .1
90 R1=.1
100 X1=1
110 KG=10
120 V1     = 1.038
130 VLIMIT  = 2.5
140 KV=-.8
150 KD = -150
160 REM   SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
170 FOR LTYPE = 1 TO 2 STEP 1
180 IF(LTYPE=1) GOTO 220
190 LPRINT
200 LPRINT "REALISTIC LOAD REPRESENTATION"
210 GOTO 240
220 LPRINT "CONSTANT IMPEDANCE LOAD"
230 REM SET THE INPUT POWER
240 FOR PG = .02 TO .2 STEP .02
250 LPRINT
260 LPRINT
270 LPRINT "SYS V   P IN   DSG P   DSG Q  DSG PF   SYS P   SYS Q   SYS PF  LOAD
V  DELTA"
280 VT   = .88
290 REM SET THE SYSTEM VOLTAGE
300 FOR VS = .9 TO 1.1 STEP .02
310 DELTA = 11
320 VITER = 0
330 DITER = 0
340 REM  START HERE WITH INTERNAL ITERATION LOOP FINDING ANGLE
350 DITER = DITER +1
360 VITER = VITER +1
370 V1R=V1*COS(DELTA*3.1416/180)
380 V1I     = V1*SIN(DELTA*3.14159/180)
390 A=V1R-VT
400 B=V1I
410 C=R1
420 D=X1
430 GOSUB 1460
440 I1R      = DIVR
450 I1I      = DIVI
460 REM      GOT CURRENT, NOW FIND THE POWER
470 REM
480 A     = V1R
490 B      = V1I
```

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION


```
500 C      = I1R
510 D      = -I1I
520 GOSUB 1460
530 INPWR = PRODR
540 PRINT "CALCULATED INPUT POWER IS ";INPWR;" AND PG IS ";PG
550 PWRERR= INPWR - PG
560 IF(ABS(PWRERR)<.0001)GOTO 710
570 DELTA     = DELTA + KD*PWRERR
580 IF DELTA < 90 GOTO 610
590 PRINT "DELTA EXCEEDS STEADY STATE LIMIT, CASE TERMINATED"
600 GOTO 1380
610 KD = -50
620 IF DELTA < 10 GOTO 680
630 KD = -100
640 IF DELTA < 30 GOTO 680
650 KD = -200
660 IF DELTA < 50 GOTO 680
670 KD = -250
680 PRINT "DELTA = ";DELTA;"";"AT ITERATION ";DITER
690 GOTO 350
700 REM FALL THROUGH HERE WHEN THE DELTA IS CORRECT
710 PRINT "DELTA ITERATED ";DITER;" TIMES"
720 REM
730 REM NOW ITS TIME TO FIND THE VOLTAGE CONDITIONS
740 REM
750 REM FIRST FIND I2 BY ADDING I1 AND IL
760 REM     CALCULATE IL
770 REM   CHECK THE LOAD TYPE
780 IF (LTYPE = 1) GOTO 810
790 N     = 1.3
800 GOTO 820
810 N     = 2
820 ILR   = .8*(VT^(N-1))
830 ILI   = -.6*(VT^(N-1))
840 REM     WITH IL AND I1 FIND I2
850 I2R   = ILR - I1R
860 I2I   = ILI - I1I
870 REM
880 REM NOW FIND THE ZS DROP
890 REM
900 A     = I2R
910 B     = I2I
920 C     = RS
930 D     = XS
940 GOSUB 1460
950 ZSDRR= PRODR
960 ZSDRI= PRODI
970 REM
980 REM NOW WE GOT THE VALUE OF VS:
990 REM
```

TABLE A-III, cont.

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION


```
1000 VSR   = VT + ZSDRR
1010 VSI   = +ZSDRI
1020 MAGVS= SQR(VSR^2 + VSI^2)
1030 REM
1040 REM COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
1050 REM
1060 VERR = MAGVS - VS
1070 IF(ABS(VERR)<.0001)GOTO 1130
1080 VT    = VT + KV*VERR
1090 PRINT "TERMINAL VOLTS ";VT;" AT VOLTAGE ITERATION ";VITER
1100 GOTO 330
1110 REM
1120 REM FALL THROUGH HERE WHEN VOLTAGE CONDITIONS ARE CORRECT
1130 REM  TIME TO CALCULATE ALL THE VALUES NEEDED FOR THE PRINTOUT
1140 REM
1150 REM  FIRST THE DSG PARAMETERS
1160 REM
1170 A     = VT
1180 B     = 0
1190 C     = I1R
1200 D     = -I1I
1210 GOSUB 1460
1220 DSGP = PRODR
1230 DSGQ = PRODI
1240 DSGPF = COS(ATN(DSGQ/DSGP))
1250 REM
1260 REM     NOW FOR THE SYSTEM PARAMETERS
1270 A     = VT
1280 B     = 0
1290 C     = I2R
1300 D     = -I2I
1310 GOSUB 1460
1320 SYSP = PRODR
1330 SYSQ = PRODI
1340 SYSPF    = COS(ATN(SYSQ/SYSP))
1350 LPRINT USING "#.##    ";VS;
1360 LPRINT USING "#.###    ";PG;DSGP;DSGQ;DSGPF;SYSP;SYSQ;SYSPF;VT;
1370 LPRINT USING "##.##";DELTA
1380 NEXT VS
1390 VT    = .88
1400 NEXT PG
1410 NEXT LTYPE
1420 STOP
1430 PRINT "NO EXCITATION, CASE TERMINATED"
1440 GOTO 1380
1450 REM
1460 REM     SUBROUTINE TO FIND COMPLEX PRODUCTS AND DO COMPLEX DIVISIONS
1470 PRODR = A * C - B * D
1480 PRODI = B * C + A * D
1490 DEN    = C*C +D*D
```

LISTING FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION

```
1500 DIVFLG = 0
1510 IF (DEN=0)GOTO 1550
1520 DIVR  = (A*C + B*D)/DEN
1530 DIVI  = (B*C - A*D)/DEN
1540 RETURN
1550 DIVFLG = 1
1560 REM CHECK DIVFLG ON DIVISIONS BY VARIABLES ONLY
1570 RETURN
```

TABLE A-IV

LISTING FOR INDUCTION MACHINE


```
10 REM KIRKHAM'S FAMOUS VOLTAGE STUDY     FILE B:INDU
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE CASE OF AN INDUCTION GENERATOR"
40 REM
50 REM INITIALIZE
60 REM
70 RS      = .04
80 XS      = .1
90 RL      = .8
100 XL     = .6
110 KV     = -.875
120 KS     = .1
130 R2     = .1
140 R1     = .1
150 X1     = 1
160 X2     = 1
170 RM     = 10
180 XM     = 40
190 REM   SET THE LOAD TYPE   (1 FOR RESISTIVE, 2 FOR MORE REALISM)
200 FOR LTYPE = 1 TO 2 STEP 1
210 IF(LTYPE=1) GOTO 290
220 LPRINT
230 LPRINT
240 LPRINT
250 LPRINT
260 LPRINT
270 LPRINT "REALISTIC LOAD REPRESENTATION"
280 GOTO 310
290 LPRINT "CONSTANT IMPEDANCE LOAD"
300 REM SET THE INPUT POWER
310 FOR PG = .02 TO .2 STEP .02
320 LPRINT
330 LPRINT
340 LPRINT "SYS V   P IN   DSG P   DSG Q DSG PF  10 * S   SYS P   SYS Q   SYS P
F  LOAD V"
350 VT      = 1
360 REM SET THE SYSTEM VOLTAGE
370 FOR VS = .9 TO 1.1 STEP .02
380 VITER  = 0
390 SITER  = 0
400 REM  START HERE WITH INTERNAL ITERATION LOOP FINDING SLIP
410 S       = -.00005
420 REM     FIND THE PARALLEL COMBINATION
430 SITER  = SITER +1
440 VITER  = VITER +1
450 A       = RM
460 B       = XM
470 C       = R2/S
480 D       = X2
490 GOSUB 1950
```

TABLE A-IV, cont.

LISTING FOR INDUCTION MACHINE

```
500 NUMR    = PRODR
510 NUMI    = PRODI
520 REM     GOT PRODUCT       DO DIVISION
530 REM
540 A       = NUMR
550 B       = NUMI
560 C       = RM + R2/S
570 D       = XM + X2
580 GOSUB 1950
590 ZPR     = DIVR
600 ZPI     = DIVI
610 REM       GOT PARALLEL COMBO NOW
620 REM     NOW ADD THE Z1 TERMS
630 REFF    = ZPR + R1
640 XEFF    = ZPI + X1
650 REM
660 REM NOW APPLY VT TO FIND I1
670 A       = VT
680 B       = 0
690 C       = REFF
700 D       = XEFF
710 GOSUB 1950
720 I1R     = -DIVR
730 I1I     = -DIVI
740 REM
750 REM
760 REM NOW FIND DROP ACROSS Z1
770 A       = I1R
780 B       = I1I
790 C       = R1
800 D       = X1
810 GOSUB 1950
820 DR1R    = PRODR
830 DR1I    = PRODI
840 REM
850 REM NOW WE KNOW VT AND THE Z1 DROP, SO LET'S FIND V1
860 REM
870 V1R     = VT + DR1R
880 V1I     = DR1I
890 REM
900 REM NOW WE CAN FIND IM, THE SHUNT TERM
910 REM
920 A       = V1R
930 B       = V1I
940 C       = RM
950 D       = XM
960 GOSUB 1950
970 IMR     = DIVR
980 IMI     = DIVI
990 REM
```

LISTING FOR INDUCTION MACHINE


```
1000 REM NOW FIND IG BY ADDING I1 AND IM
1010 REM
1020 IGR    = I1R + IMR
1030 IGI    = I1I + IMI
1040 REM
1050 REM NOW FIND THE INPUT POWER TO THE MACHINE
1060 REM
1070 A      = V1R
1080 B      = V1I
1090 C      = IGR
1100 D      = - IGI
1110 GOSUB 1950
1120 INPWR = PRODR
1130 PRINT "CALCULATED INPUT POWER IS ";INPWR;" AND PG IS ";PG
1140 PWRERR= INPWR - PG
1150 IF(ABS(PWRERR)<.00001)GOTO 1210
1160 S      = S + KS*PWRERR
1170 IF S<-.1 GOTO 1920
1180 PRINT "SLIP = ";S;"AT ITERATION ";SITER
1190 GOTO 430
1200 REM FALL THROUGH HERE WHEN THE SLIP IS CORRECT
1210 PRINT "SLIP ITERATED ";SITER;" TIMES"
1220 REM
1230 REM NOW ITS TIME TO FIND THE VOLTAGE CONDITIONS
1240 REM
1250 REM FIRST FIND I1 BY ADDING I1 AND IL
1260 REM     CALCULATE IL
1270 REM   CHECK THE LOAD TYPE
1280 IF (LTYPE = 1) GOTO 1310
1290 N      = 1.3
1300 GOTO 1320
1310 N      = 2
1320 ILR    = .08*(VT^(N-1))
1330 ILI    = -.06*(VT^(N-1))
1340 REM      WITH IL AND I1 FIND I2
1350 I2R    = ILR - I1R
1360 I2I    = ILI - I1I
1370 REM
1380 REM NOW FIND THE ZS DROP
1390 REM
1400 A      = I2R
1410 B      = I2I
1420 C    =  RS
1430 D      = XS
1440 GOSUB 1950
1450 ZSDRR = PRODR
1460 ZSDRI = PRODI
1470 REM
1480 REM NOW WE GOT THE VALUE OF VS:
1490 REM
```

LISTING FOR INDUCTION MACHINE

```
1500 VSR    = VT + ZSDRR
1510 VSI    = +ZSDRI
1520 MAGVS = SQR(VSR^2 + VSI^2)
1530 REM
1540 REM COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
1550 REM
1560 VERR   = MAGVS - VS
1570 IF(ABS(VERR)<.0001)GOTO 1630
1580 VT     = VT + KV*VERR
1590 PRINT "TERMINAL VOLTS ";VT;" AT VOLTAGE ITERATION ";VITER
1600 GOTO 390
1610 REM
1620 REM FALL THROUGH HERE WHEN VOLTAGE CONDITIONS ARE CORRECT
1630 REM  TIME TO CALCULATE ALL THE VALUES NEEDED FOR THE PRINTOUT
1640 REM
1650 REM  FIRST THE DSG PARAMETERS
1660 REM
1670 A      = VT
1680 B      = 0
1690 C      = I1R
1700 D      = -I1I
1710 GOSUB 1950
1720 DSGP   = PRODR
1730 DSGQ   = PRODI
1740 DSGPF = COS(ATN(DSGQ/DSGP))
1750 REM
1760 REM     NOW FOR THE SYSTEM PARAMETERS
1770 A      = VT
1780 B      = 0
1790 C      = I2R
1800 D      = -I2I
1810 GOSUB 1950
1820 SYSP   = PRODR
1830 SYSQ   = PRODI
1840 SYSPF = COS(ATN(SYSQ/SYSP))
1850 LPRINT USING "#.##    ";VS;
1860 LPRINT USING "#.###    ";PG;DSGP;DSGQ;DSGPF;10*S;SYSP;SYSQ;SYSPF;VT
1870 VT     = VT*1.05
1880 NEXT VS
1890 NEXT PG
1900 NEXT LTYPE
1910 STOP
1920 PRINT "NO CONVERGENCE -- CASE TERMINATED"
1930 GOTO 1870
1940 REM
1950 REM     SUBROUTINE TO FIND COMPLEX PRODUCTS AND DO COMPLEX DIVISIONS
1960 PRODR = A * C - B * D
1970 PRODI = B * C + A * D
1980 DEN    = C*C +D*D
1990 DIVFLG = 0
```

LISTING FOR INDUCTION MACHINE


```
2000 IF (DEN=0)GOTO 2040
2010 DIVR  = (A*C + B*D)/DEN
2020 DIVI  = (B*C - A*D)/DEN
2030 RETURN
2040 DIVFLG = 1
2050 REM CHECK DIVFLG ON DIVISIONS BY VARIABLES ONLY
2060 RETURN
```

TABLE A-V

LISTING FOR INDUCTION MACHINE, POWER FACTOR CORRECTED

```
10 REM KIRKHAM'S FAMOUS VOLTAGE STUDY     FILE B:COMPINDU
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE CASE OF AN INDUCTION GENERATOR"
40 REM
50 REM INITIALIZE
60 REM
70 RS      = .04
80 XS      = .1
90 RL      = .8
100 XL     = .6
110 KV     = -.875
120 KS     = .1
130 R2     = .1
140 R1     = .1
150 X1     = 1
160 X2     = 1
170 RM     = 10
180 XM     = 40
190 REM   SET THE LOAD TYPE   (1 FOR RESISTIVE, 2 FOR MORE REALISM)
200 FOR LTYPE = 1 TO 4 STEP 1
210 IF(LTYPE=1) GOTO 300
220 IF LTYPE = 3 GOTO 300
230 LPRINT
240 LPRINT
250 LPRINT
260 LPRINT
270 LPRINT
280 LPRINT "REALISTIC LOAD REPRESENTATION"
290 GOTO 320
300 LPRINT "CONSTANT IMPEDANCE LOAD"
310 REM SET THE INPUT POWER
320 FOR PG = .02 TO .2 STEP .02
330 LPRINT
340 LPRINT
350 LPRINT "SYS V   P IN   DSG P   DSG Q DSG PF  10 * S   SYS P   SYS Q   SYS
F  LOAD V"
360 VT     = 1
370 REM SET THE SYSTEM VOLTAGE
380 FOR VS = .9 TO 1.1 STEP .02
390 VITER  = 0
400 SITER  = 0
410 REM  START HERE WITH INTERNAL ITERATION LOOP FINDING SLIP
420 S      = -.0005
430 REM    FIND THE PARALLEL COMBINATION
440 SITER  = SITER +1
450 VITER  = VITER +1
460 A      = RM
470 B      = XM
480 C      = R2/S
490 D      = X2
```

LISTING FOR INDUCTION MACHINE, POWER FACTOR CORRECTED


```
500 GOSUB 2060
510 NUMR    = PRODR
520 NUMI    = PRODI
530 REM     GOT PRODUCT       DO DIVISION
540 REM
550 A       = NUMR
560 B       = NUMI
570 C       = RM + R2/S
580 D       = XM + X2
590 GOSUB 2060
600 ZPR     = DIVR
610 ZPI     = DIVI
620 REM       GOT PARALLEL COMBO NOW
630 REM     NOW ADD THE Z1 TERMS
640 REFF    = ZPR + R1
650 XEFF    = ZPI + X1
660 REM
670 REM NOW APPLY VT TO FIND I1
680 A       = VT
690 B       = 0
700 C       = REFF
710 D       = XEFF
720 GOSUB 2060
730 I1R     = -DIVR
740 I1I     = -DIVI
750 REM  CORRECT THE DSG POWER FACTOR TO UNITY
760 REM  AT FULL LOAD INTO RATED VOLTAGE
770  I1I    = I1I -.120532*VT
780 REM
790 REM
800 REM NOW FIND DROP ACROSS Z1
810 A       = I1R
820 B       = I1I
830 C       = R1
840 D       = X1
850 GOSUB 2060
860 DR1R    = PRODR
870 DR1I    = PRODI
880 REM
890 REM NOW WE KNOW VT AND THE Z1 DROP, SO LET'S FIND V1
900 REM
910 V1R     = VT + DR1R
920 V1I     = DR1I
930 REM
940 REM NOW WE CAN FIND IM, THE SHUNT TERM
950 REM
960 A       = V1R
970 B       = V1I
980 C       = RM
990 D       = XM
```

LISTING FOR INDUCTION MACHINE, POWER FACTOR CORRECTED

```
1000 GOSUB 2060
1010 IMR    = DIVR
1020 IMI    = DIVI
1030 REM
1040 REM NOW FIND IG BY ADDING I1 AND IM
1050 REM
1060 IGR   = I1R + IMR
1070 IGI   = I1I + IMI
1080 REM
1090 REM NOW FIND THE INPUT POWER TO THE MACHINE
1100 REM
1110 A     = V1R
1120 B     = V1I
1130 C     = IGR
1140 D     = - IGI
1150 GOSUB 2060
1160 INPWR = PRODR
1170 PRINT "CALCULATED INPUT POWER IS ";INPWR;" AND PG IS ";PG
1180 PWRERR= INPWR - PG
1190 IF(ABS(PWRERR)<.0001)GOTO 1250
1200 S     = S + KS*PWRERR
1210 IF S<-.1 GOTO 2030
1220 PRINT "SLIP = ";S;"AT ITERATION ";SITER
1230 GOTO 440
1240 REM FALL THROUGH HERE WHEN THE SLIP IS CORRECT
1250 PRINT "SLIP ITERATED ";SITER;" TIMES"
1260 REM
1270 REM NOW ITS TIME TO FIND THE VOLTAGE CONDITIONS
1280 REM
1290 REM FIRST FIND I1 BY ADDING I1 AND IL
1300 REM    CALCULATE IL
1310 REM   CHECK THE LOAD TYPE
1320 IF (LTYPE = 1) GOTO 1360
1330 IF LTYPE = 3 GOTO 1360
1340 N     = 1.3
1350 GOTO 1370
1360 N     = 2
1370 ILR   = .08*(VT^(N-1))
1380 ILI   = -.06*(VT^(N-1))
1390 IF LTYPE = 3 GOTO 1440
1400 IF LTYPE = 4 GOTO 1440
1410 ILR = 10*ILR
1420 ILI = 10*ILI
1430 REM     WITH IL AND I1 FIND I2
1440 I2R   = ILR - I1R
1450 I2I   = ILI - I1I
1460 REM
1470 REM NOW FIND THE ZS DROP
1480 REM
1490 A     = I2R
```

LISTING FOR INDUCTION MACHINE, POWER FACTOR CORRECTED


```
1500 B      = I2I
1510 C    =  RS
1520 D      = XS
1530 GOSUB 2060
1540 ZSDRR = PRODR
1550 ZSDRI = PRODI
1560 REM
1570 REM NOW WE GOT THE VALUE OF VS:
1580 REM
1590 VSR    = VT + ZSDRR
1600 VSI    = +ZSDRI
1610 MAGVS = SQR(VSR^2 + VSI^2)
1620 REM
1630 REM COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
1640 REM
1650 VERR   = MAGVS - VS
1660 IF(ABS(VERR)<.0001)GOTO 1730
1670 VT     = VT + KV*VERR
1680 PRINT "TERMINAL VOLTS ";VT;" AT VOLTAGE ITERATION ";VITER
1690 IF S > -.04 GOTO 440
1700 GOTO 400
1710 REM
1720 REM FALL THROUGH HERE WHEN VOLTAGE CONDITIONS ARE CORRECT
1730 REM  TIME TO CALCULATE ALL THE VALUES NEEDED FOR THE PRINTOUT
1740 REM
1750 REM  FIRST THE DSG PARAMETERS
1760 REM
1770 A      = VT
1780 B      = 0
1790 C      = I1R
1800 D      = -I1I
1810 GOSUB 2060
1820 DSGP   = PRODR
1830 DSGQ   = PRODI
1840 DSGPF  = COS(ATN(DSGQ/DSGP))
1850 REM
1860 REM    NOW FOR THE SYSTEM PARAMETERS
1870 A      = VT
1880 B      = 0
1890 C      = I2R
1900 D      = -I2I
1910 GOSUB 2060
1920 SYSP   = PRODR
1930 SYSQ   = PRODI
1940 SYSPF  = COS(ATN(SYSQ/SYSP))
1950 REM LPRINT "CALCULATED UNCORRECTED VALUES I1R AND I1I ";I1R;I1I
1960 LPRINT USING "#.##    ";VS;
1970 LPRINT USING "#.###    ";PG;DSGP;DSGQ;DSGPF;10*S;SYSP;SYSQ;SYSPF;VT
1980 VT     = VT*1.05
1990 NEXT VS
```

LISTING FOR INDUCTION MACHINE, POWER FACTOR CORRECTED

```
2000 NEXT PG
2010 NEXT LTYPE
2020 STOP
2030 PRINT "NO CONVERGENCE -- CASE TERMINATED"
2040 GOTO 1980
2050 REM
2060 REM    SUBROUTINE TO FIND COMPLEX PRODUCTS AND DO COMPLEX DIVISIONS
2070 PRODR = A * C - B * D
2080 PRODI = B * C + A * D
2090 DEN   = C*C +D*D
2100 DIVFLG = 0
2110 IF (DEN=0)GOTO 2150
2120 DIVR  = (A*C + B*D)/DEN
2130 DIVI  = (B*C - A*D)/DEN
2140 RETURN
2150 DIVFLG = 1
2160 REM CHECK DIVFLG ON DIVISIONS BY VARIABLES ONLY
2170 RETURN
```

TABLE A-VI

LISTING FOR INVERTER, CEA CONTROL


```
REM THE FAMOUS VOLTAGE STUDY                   FILE B:DCINV
REM
LPRINT "THIS PROGRAM CALCULATES THE CASE OF AN INVERTOR SYSTEM"
REM
REM
REM INITIALIZE
REM
RS = .04
XS = .1
 KV = -1
 REM  SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
 FOR LTYPE = 1 TO 2 STEP 1
 LPRINT
 LPRINT  "FULL LOAD CASE"
 LPRINT
 IF LTYPE = 1 GOTO 190
 LPRINT "REALISTIC LOAD REPRESENTATION"
 GOTO 200
 LPRINT "CONSTANT IMPEDANCE LOAD"
 FOR PG   = .02 TO .2 STEP .02
 QG       = -.5* PG
 LPRINT
 LPRINT
 LPRINT "SYS V  DSG P    DSG Q    DSG PF   SYS P    SYS Q    SYS PF   LOAD V"
 VT      = .9
 REM SET THE SYSTEM VOLTAGE
 FOR VS = .9 TO 1.1 STEP .02
 VITER   = 0
 REM START HERE WITH THE ITERATION ON TERMINAL VOLTAGE
 VITER   = VITER + 1
 REM CALCULATE I1
 A       = PG
 B       = QG
 C       = VT
 D       = 0
 GOSUB 950
 I1R     = DIVR
 I1I     = -DIVI
 REM NOW CALCULATE IL
 REM FIRST CHECK THE LOAD TYPE
 IF LTYPE = 1 GOTO 440
 N        = 1.3
 GOTO 450
 N        = 2
 ILR      = .8*(VT^(N-1))
 ILI      =-.6*(VT^(N-1))
 REM
 REM   NOW FIND THE ZS DROP
 REM
```

LISTING FOR INVERTER, CRA CONTROL


```
500 I2R      = ILR - I1R
510 I2I      = ILI - I1I
520 A        = I2R
530 B        = I2I
540 C        = RS
550 D        = XS
560 GOSUB 950
570 ZSDRR    = PRODR
580 ZSDRI    = PRODI
590 REM
600 REM  NOW WE GOT ENOUGH TO FIND THE VALUE OF VS
610 REM
620 VSR      = VT + ZSDRR
630 VSI      = ZSDRI
640 MAGVS    = SQR(VSR^2 + VSI^2)
650 REM
660 REM   COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
670 REM
680 VERR     = MAGVS - VS
690 IF ABS(VERR) < .0001 GOTO 750
700 VT       = VT + KV*VERR
710 PRINT "TERMINAL VOLTS ";VT;"AT VOLTAGE ITERATION ";VITER
720 GOTO 300
730 REM
740 REM  FALL THROUGH HERE WHEN THE VOLTAGE CONDITIONS MATCH
750 REM  SINCE THIS IS THE ONLY ITERATION, IT MUST BE TIME
760 REM  TO GO CALCULATE ALL THE VALUES NEEDED FOR THE LISTING
770 REM
780 DSGPF   = COS(ATN(QG/PG))
790 A       = VT
800 B       = 0
810 C       = I2R
820 D       = -I2I
830 GOSUB 950
840 SYSP    = PRODR
850 SYSQ    = PRODI
860 SYSPF   = COS(ATN(SYSQ/SYSP))
870 LPRINT USING "#.##    ";VS;
880 LPRINT USING "#.###     ";PG;QG;DSGPF;SYSP;SYSQ;SYSPF;
890 LPRINT USING "#.###    ";VT
900 NEXT VS
910 VT     = .9
920 NEXT PG
930 NEXT LTYPE
940 STOP
950 REM
960 REM UNIVERSAL SUBROUTINE FOR COMPLEX ALGEBRA
970 REM
980 PRODR    = A*C-B*D
990 PRODI    = B*C+A*D
```

LISTING FOR INVERTER, CEA CONTROL

```
1000 DEN      = C^2+D^2
1010 IF DEN   = 0 GOTO 1050
1020 DIVR     = (A*C+B*D)/DEN
1030 DIVI     = (B*C-A*D)/DEN
1040 RETURN
1050 DIVFLG   = 1
1060 RETURN
```

TABLE A-VII

LISTING FOR INVERTER, CEA - COMPENSATED

ORIGINAL PAGE IS
OF POOR QUALITY

```
10 REM THE FAMOUS VOLTAGE STUDY                     FILE B:COMPINV
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE CASE OF AN INVERTOR SYSTEM"
40 LPRINT
50 LPRINT
60 LPRINT "CEA CONTROLLER COMPENSATED AT FULL LOAD"
70 REM
80 REM
90 REM INITIALIZE
100 REM
110 RS = .04
120 XS = .1
130 KV = -1
140 REM  SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
150 FOR LTYPE = 1 TO 2 STEP 1
160 LPRINT
170 LPRINT
180 IF LTYPE = 1 GOTO 210
190 LPRINT "REALISTIC LOAD REPRESENTATION     HEAVY LOAD CASE"
200 GOTO 220
210 LPRINT "CONSTANT IMPEDANCE LOAD           HEAVY LOAD CASE"
220 FOR PG  = .02 TO .2 STEP .02
230 QG      = -.5* PG
240 LPRINT
250 LPRINT
260 LPRINT "SYS V  DSG P    DSG Q    DSG PF   SYS P    SYS Q    SYS PF   LOAD
270 VT      = .9
280 REM SET THE SYSTEM VOLTAGE
290 FOR VS = .9 TO 1.1 STEP .02
300 VITER  = 0
310 REM START HERE WITH THE ITERATION ON TERMINAL VOLTAGE
320 VITER  = VITER + 1
330 REM CALCULATE I1
340 A       = PG
350 B       = QG
360 C       = VT
370 D       = 0
380 GOSUB 990
390 I1R     = DIVR
400 I1I     = -DIVI
410 I1I   = I1I - .1*VT
420 REM NOW CALCULATE IL
430 REM FIRST CHECK THE LOAD TYPE
440 IF LTYPE = 1 GOTO 470
450 N        = 1.3
460 GOTO 480
470 N        = 2
480 ILR      = .8*(VT^(N-1))
490 ILI      =-.6*(VT^(N-1))
```

TABLE A-VII, cont.

LISTING FOR INVERTER, CEA - COMPENSATED


```
500 REM
510 REM   NOW FIND THE ZS DROP
520 REM
530 I2R      = ILR - I1R
540 I2I      = ILI - I1I
550 A        = I2R
560 B        = I2I
570 C        = RS
580 D        = XS
590 GOSUB 990
600 ZSDRR    = PRODR
610 ZSDRI    = PRODI
620 REM
630 REM  NOW WE GOT ENOUGH TO FIND THE VALUE OF VS
640 REM
650 VSR      = VT + ZSDRR
660 VSI      = ZSDRI
670 MAGVS    = SQR(VSR^2 + VSI^2)
680 REM
690 REM   COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
700 REM
710 VERR     = MAGVS - VS
720 IF ABS(VERR) < .000001 GOTO 780
730 VT       = VT + KV*VERR
740 PRINT "TERMINAL VOLTS ";VT;"AT VOLTAGE ITERATION ";VITER
750 GOTO 320
760 REM
770 REM  FALL THROUGH HERE WHEN THE VOLTAGE CONDITIONS MATCH
780 REM  SINCE THIS IS THE ONLY ITERATION, IT MUST BE TIME
790 REM  TO GO CALCULATE ALL THE VALUES NEEDED FOR THE LISTING
800 REM
810 DSGQ    = -I1I*VT
820 DSGPF   = COS (ATN(DSGQ/PG))
830 A       = VT
840 B       = 0
850 C       = I2R
860 D       = -I2I
870 GOSUB 990
880 SYSP    = PRODR
890 SYSQ    = PRODI
900 SYSPF   = COS(ATN(SYSQ/SYSP))
910 LPRINT USING "#.##    ";VS;
920 LPRINT USING "#.###     ";PG;DSGQ;DSGPF;SYSP;SYSQ;SYSPF;
930 LPRINT USING "#.###    ";VT
940 NEXT VS
950 VT     = .9
960 NEXT PG
970 NEXT LTYPE
980 STOP
990 REM
```

TABLE A-VII, cont.

LISTING FOR INVERTER, CEA - COMPENSATED

```
1000 REM UNIVERSAL SUBROUTINE FOR COMPLEX ALGEBRA
1010 REM
1020 PRODR   = A*C-B*D
1030 PRODI   = B*C+A*D
1040 DEN     = C^2+D^2
1050 IF DEN  = 0 GOTO 1090
1060 DIVR    = (A*C+B*D)/DEN
1070 DIVI    = (B*C-A*D)/DEN
1080 RETURN
1090 DIVFLG  = 1
1100 RETURN
```

TABLE A-VIII

LISTING FOR PV TYPE INVERTER

```
0 REM THE FAMOUS VOLTAGE STUDY
0 REM
0 LPRINT "THIS PROGRAM CALCULATES THE CASE OF AN INVERTOR SYSTEM"
0 REM
0 REM
0 REM INITIALIZE
0 REM
0 RS = .04
0 XS = .1
00 KV = -1
10 REM  SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
20 FOR LTYPE = 1 TO 2 STEP 1
30 LPRINT
40 LPRINT  "FULL LOAD CASE"
50 LPRINT
60 IF LTYPE = 1 GOTO 190
70 LPRINT "REALISTIC LOAD REPRESENTATION"
80 GOTO 200
90 LPRINT "CONSTANT IMPEDANCE LOAD"
00 FOR PG  = .02 TO .2 STEP .02
10 QG = -.06 - .1*PG
20 LPRINT
30 LPRINT
40 LPRINT "SYS V  DSG P    DSG Q    DSG PF   SYS P    SYS Q    SYS PF   LOAD V"
50 VT      = .9
60 REM SET THE SYSTEM VOLTAGE
70 FOR VS = .9 TO 1.1 STEP .02
80 VITER   = 0
90 REM START HERE WITH THE ITERATION ON TERMINAL VOLTAGE
00 VITER   = VITER + 1
10 REM CALCULATE I1
20 A       = PG
30 B       = QG
40 C       = VT
50 D       = 0
60 GOSUB 950
70 I1R     = DIVR
80 I1I     = -DIVI
90 REM NOW CALCULATE IL
00 REM FIRST CHECK THE LOAD TYPE
10 IF LTYPE = 1 GOTO 440
20 N        = 1.3
30 GOTO 450
40 N        = 2
50 ILR      = .8*(VT^(N-1))
60 ILI      =-.6*(VT^(N-1))
```

TABLE A-VIII, cont.

LISTING FOR PV TYPE INVERTER


```
470 REM
480 REM   NOW FIND THE ZS DROP
490 REM
500 I2R      = ILR - I1R
510 I2I      = ILI - I1I
520 A        = I2R
530 B        = I2I
540 C        = RS
550 D        = XS
560 GOSUB 950
570 ZSDRR    = PRODR
580 ZSDRI    = PRODI
590 REM
600 REM  NOW WE GOT ENOUGH TO FIND THE VALUE OF VS
610 REM
620 VSR      = VT + ZSDRR
630 VSI      = ZSDRI
640 MAGVS    = SQR(VSR^2 + VSI^2)
650 REM
660 REM   COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
670 REM
680 VERR     = MAGVS - VS
690 IF ABS(VERR) < .0001 GOTO 750
700 VT       = VT + KV*VERR
710 PRINT "TERMINAL VOLTS ";VT;"AT VOLTAGE ITERATION ";VITER
720 GOTO 300
730 REM
740 REM  FALL THROUGH HERE WHEN THE VOLTAGE CONDITIONS MATCH
750 REM  SINCE THIS IS THE ONLY ITERATION, IT MUST BE TIME
760 REM  TO GO CALCULATE ALL THE VALUES NEEDED FOR THE LISTING
770 REM
780 DSGPF   = COS(ATN(QG/PG))
790 A       = VT
800 B       = 0
810 C       = I2R
820 D       = -I2I
830 GOSUB 950
840 SYSP    = PRODR
850 SYSQ    = PRODI
860 SYSPF   = COS(ATN(SYSQ/SYSP))
870 LPRINT USING "#.##    ";VS;
880 LPRINT USING "#.###     ";PG;QG;DSGPF;SYSP;SYSQ;SYSPF;
890 LPRINT USING "#.###    ";VT
900 NEXT VS
910 VT     = .9
920 NEXT PG
930 NEXT LTYPE
940 STOP
```

LISTING FOR PV TYPE INVERTER


```
950 REM
960 REM UNIVERSAL SUBROUTINE FOR COMPLEX ALGEBRA
970 REM
980 PRODR   = A*C-B*D
990 PRODI   = B*C+A*D
1000 DEN     = C^2+D^2
1010 IF DEN  = 0 GOTO 1050
1020 DIVR    = (A*C+B*D)/DEN
1030 DIVI    = (B*C-A*D)/DEN
1040 RETURN
1050 DIVFLG  = 1
1060 RETURN
```

TABLE A-IX

LISTING FOR BASE CASE

```
10 REM  FAMOUS VOLTAGE STUDY       FILE B:BASE
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE BASE CASE OF NO DSG "
40 REM
50 REM INITIALIZE
60 REM
70 RS     = .04
80 XS     = .1
90 R1=.1
100 X1=1
110 KV    = -.9
120 REM   SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
130 FOR LTYPE = 1 TO 2 STEP 1
140 IF(LTYPE=1) GOTO 180
150 LPRINT
160 LPRINT "REALISTIC LOAD REPRESENTATION"
170 GOTO 220
180 LPRINT
190 LPRINT
200 LPRINT "CONSTANT IMPEDANCE LOAD"
210 REM SET THE INPUT POWER
220 LPRINT
230 LPRINT
240 LPRINT "SYS V   SYS P   SYS Q   SYS PF  LOAD V"
250 VT    = .88
260 REM SET THE SYSTEM VOLTAGE
270 FOR VS = .9 TO 1.1 STEP .02
280 VITER = 0
290 DITER = 0
300 REM  START HERE WITH INTERNAL ITERATION LOOP FINDING ANGLE
310 DITER = DITER +1
320 VITER = VITER +1
330 REM
340 REM NOW ITS TIME TO FIND THE VOLTAGE CONDITIONS
350 REM
360 REM    CALCULATE IL
370 REM   CHECK THE LOAD TYPE
380 IF (LTYPE = 1) GOTO 410
390 N     = 1.3
400 GOTO 420
410 N     = 2
420 ILR   = .8*(VT^(N-1))
430 ILI   = -.6*(VT^(N-1))
440 REM
450 REM NOW FIND THE ZS DROP
460 REM
470 A     = ILR
480 B     = ILI
490 C     = RS
```

LISTING FOR BASE CASE


```
500 D     = XS
510 GOSUB 900
520 ZSDRR= PRODR
530 ZSDRI= PRODI
540 REM
550 REM NOW WE GOT THE VALUE OF VS:
560 REM
570 VSR   = VT + ZSDRR
580 VSI   = +ZSDRI
590 MAGVS= SQR(VSR^2 + VSI^2)
600 REM
610 REM COMPARE THE VALUE OF VS AND MAGVS, AND CORRECT IF NEEDED
620 REM
630 VERR = MAGVS - VS
640 IF(ABS(VERR)<.0001)GOTO 700
650 VT    = VT + KV*VERR
660 PRINT "TERMINAL VOLTS ";VT;" AT VOLTAGE ITERATION ";VITER
670 GOTO 290
680 REM
690 REM FALL THROUGH HERE WHEN VOLTAGE CONDITIONS ARE CORRECT
700 REM  TIME TO CALCULATE ALL THE VALUES NEEDED FOR THE PRINTOUT
710 REM
720 REM     NOW FOR THE SYSTEM PARAMETERS
730 A     = VT
740 B     = 0
750 C     = ILR
760 D     = -ILI
770 GOSUB 900
780 SYSP = PRODR
790 SYSQ = PRODI
800 SYSPF   = COS(ATN(SYSQ/SYSP))
810 LPRINT USING "#.##     ";VS;
820 LPRINT USING "#.###    ";SYSP;SYSQ;SYSPF;VT
830 NEXT VS
840 VT    = .88
850 NEXT LTYPE
860 STOP
870 PRINT "NO EXCITATION, CASE TERMINATED"
880 GOTO 830
890 REM
900 REM     SUBROUTINE TO FIND COMPLEX PRODUCTS AND DO COMPLEX DIVISIONS
910 PRODR = A * C - B * D
920 PRODI = B * C + A * D
930 DEN   = C*C +D*D
940 DIVFLG = 0
950 IF (DEN=0)GOTO 990
960 DIVR  = (A*C + B*D)/DEN
970 DIVI  = (B*C - A*D)/DEN
980 RETURN
990 DIVFLG = 1
1000 REM CHECK DIVFLG ON DIVISIONS BY VARIABLES ONLY
1010 RETURN
```

APPENDIX B

DATA LISTINGS

TABLE B-I

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
LIGHT LOAD CASE

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	-.017	0.566	0.029	0.089	-.512	0.171	0.949	1.546
0.92	0.020	-.005	0.470	0.010	0.079	-.415	0.186	0.959	1.450
0.94	0.020	0.004	0.371	0.012	0.071	-.315	0.219	0.969	1.353
0.96	0.020	0.011	0.270	0.042	0.065	-.213	0.293	0.978	1.256
0.98	0.020	0.016	0.168	0.095	0.062	-.110	0.492	0.988	1.160
1.00	0.020	0.019	0.065	0.275	0.061	-.005	0.996	0.998	1.065
1.02	0.020	0.019	-.040	0.430	0.062	0.101	0.525	1.007	0.970
1.04	0.020	0.017	-.146	0.116	0.066	0.208	0.301	1.016	0.875
1.06	0.020	0.013	-.253	0.051	0.071	0.317	0.219	1.026	0.781
1.08	0.020	0.007	-.362	0.019	0.079	0.427	0.182	1.035	0.687
1.10	0.020	-.001	-.473	0.003	0.089	0.538	0.163	1.045	0.594

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.004	0.561	0.008	0.068	-.507	0.133	0.950	1.542
0.92	0.040	0.016	0.465	0.033	0.058	-.410	0.140	0.959	1.446
0.94	0.040	0.025	0.366	0.068	0.050	-.309	0.161	0.969	1.349
0.96	0.040	0.032	0.265	0.118	0.045	-.203	0.212	0.979	1.253
0.98	0.040	0.036	0.163	0.217	0.042	-.104	0.373	0.988	1.157
1.00	0.040	0.039	0.060	0.545	0.041	0.000	1.000	0.998	1.062
1.02	0.040	0.039	-.045	0.650	0.042	0.106	0.371	1.007	0.967
1.04	0.040	0.037	-.152	0.235	0.046	0.214	0.211	1.017	0.873
1.06	0.040	0.033	-.259	0.125	0.052	0.322	0.158	1.026	0.779
1.08	0.040	0.026	-.368	0.071	0.059	0.432	0.136	1.035	0.685
1.10	0.040	0.018	-.478	0.038	0.069	0.544	0.126	1.045	0.592

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.025	0.556	0.045	0.047	-.501	0.094	0.950	1.538
0.92	0.060	0.036	0.460	0.078	0.038	-.405	0.093	0.960	1.443
0.94	0.060	0.045	0.360	0.124	0.030	-.304	0.099	0.969	1.346
0.96	0.060	0.052	0.260	0.195	0.025	-.202	0.123	0.979	1.250
0.98	0.060	0.056	0.157	0.337	0.022	-.099	0.216	0.989	1.154
1.00	0.060	0.058	0.054	0.735	0.021	0.006	0.964	0.998	1.059
1.02	0.060	0.058	-.051	0.754	0.023	0.112	0.199	1.008	0.965
1.04	0.060	0.056	-.157	0.338	0.026	0.219	0.119	1.017	0.871
1.06	0.060	0.052	-.265	0.193	0.032	0.328	0.097	1.026	0.777
1.08	0.060	0.046	-.374	0.122	0.040	0.438	0.091	1.036	0.684
1.10	0.060	0.037	-.485	0.077	0.050	0.550	0.090	1.045	0.591

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.045	0.550	0.082	0.027	-.496	0.054	0.951	1.534
0.92	0.080	0.056	0.454	0.123	0.017	-.399	0.044	0.960	1.439
0.94	0.080	0.065	0.355	0.181	0.010	-.299	0.033	0.970	1.343
0.96	0.080	0.072	0.254	0.272	0.005	-.197	0.025	0.979	1.247
0.98	0.080	0.076	0.152	0.448	0.002	-.093	0.022	0.989	1.152
1.00	0.080	0.078	0.048	0.851	0.002	0.012	0.132	0.998	1.057
1.02	0.080	0.078	-.057	0.809	0.003	0.118	0.026	1.008	0.963
1.04	0.080	0.076	-.163	0.422	0.007	0.225	0.030	1.017	0.869
1.06	0.080	0.072	-.271	0.255	0.013	0.334	0.038	1.026	0.775
1.08	0.080	0.065	-.380	0.169	0.021	0.445	0.046	1.036	0.682
1.10	0.080	0.057	-.491	0.115	0.031	0.556	0.055	1.045	0.589

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.065	0.549	0.118	0.007	-.495	0.014	0.951	1.535
0.92	0.100	0.077	0.449	0.163	-.003	-.394	0.007	0.960	1.436
0.94	0.100	0.085	0.349	0.237	-.010	-.293	0.035	0.970	1.340
0.96	0.100	0.092	0.248	0.347	-.015	-.191	0.079	0.980	1.244
0.98	0.100	0.096	0.146	0.549	-.018	-.087	0.196	0.989	1.149
1.00	0.100	0.098	0.042	0.918	-.018	0.017	0.720	0.999	1.055
1.02	0.100	0.098	-.063	0.841	-.016	0.124	0.132	1.008	0.961
1.04	0.100	0.095	-.169	0.491	-.013	0.231	0.055	1.017	0.867
1.06	0.100	0.091	-.277	0.312	-.007	0:341	0.019	1.027	0.774
1.08	0.100	0.084	-.387	0.213	0.001	0.451	0.003	1.036	0.681
1.10	0.100	0.076	-.498	0.151	0.012	0.563	0.021	1.045	0.589

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.086	0.543	0.156	-.013	-.489	0.027	0.951	1.532
0.92	0.120	0.097	0.443	0.213	-.023	-.388	0.059	0.961	1.433
0.94	0.120	0.105	0.344	0.293	-.030	-.287	0.104	0.970	1.337
0.96	0.120	0.112	0.243	0.418	-.035	-.185	0.185	0.980	1.242
0.98	0.120	0.116	0.140	0.636	-.037	-.081	0.417	0.989	1.147
1.00	0.120	0.118	0.036	0.955	-.038	0.024	0.849	0.999	1.053
1.02	0.120	0.117	-.069	0.862	-.036	0.130	0.266	1.008	0.959
1.04	0.120	0.115	-.176	0.547	-.032	0.238	0.133	1.017	0.866
1.06	0.120	0.110	-.284	0.362	-.026	0.347	0.075	1.027	0.773
1.08	0.120	0.104	-.393	0.255	-.018	0.458	0.039	1.036	0.630
1.10	0.120	0.095	-.504	0.185	-.008	0.570	0.013	1.045	0.588

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.106	0.538	0.193	-.034	-.483	0.069	0.951	1.528
0.92	0.140	0.117	0.438	0.258	-.043	-.382	0.112	0.961	1.431
0.94	0.140	0.125	0.338	0.348	-.050	-.281	0.175	0.971	1.335
0.96	0.140	0.131	0.237	0.485	-.055	-.179	0.292	0.980	1.240
0.98	0.140	0.135	0.134	0.710	-.057	-.075	0.603	0.989	1.145
1.00	0.140	0.137	0.030	0.977	-.057	0.030	0.888	0.999	1.051
1.02	0.140	0.137	-.075	0.876	-.055	0.136	0.377	1.008	0.958
1.04	0.140	0.134	-.182	0.593	-.051	0.244	0.205	1.018	0.865
1.06	0.140	0.129	-.290	0.407	-.045	0.354	0.126	1.027	0.772
1.08	0.140	0.123	-.400	0.293	-.037	0.465	0.079	1.036	0.680
1.10	0.140	0.114	-.512	0.217	-.027	0.577	0.046	1.045	0.588

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.126	0.532	0.231	-.054	-.477	0.112	0.951	1.526
0.92	0.160	0.137	0.432	0.302	-.063	-.376	0.165	0.961	1.428
0.94	0.160	0.145	0.332	0.401	-.070	-.275	0.246	0.971	1.333
0.96	0.160	0.151	0.231	0.548	-.074	-.173	0.394	0.980	1.238
0.98	0.160	0.155	0.128	0.771	-.077	-.069	0.742	0.990	1.144
1.00	0.160	0.157	0.024	0.989	-.077	0.036	0.905	0.999	1.050
1.02	0.160	0.156	-.082	0.886	-.075	0.143	0.464	1.008	0.957
1.04	0.160	0.153	-.189	0.631	-.071	0.251	0.271	1.018	0.864
1.06	0.160	0.149	-.297	0.447	-.064	0.361	0.176	1.027	0.772
1.08	0.160	0.142	-.407	0.329	-.056	0.472	0.118	1.036	0.680
1.10	0.160	0.133	-.519	0.248	-.045	0.585	0.077	1.045	0.588

ORIGINAL PAGE IS
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TABLE B-I, cont.

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.146	0.526	0.268	-.074	-.471	0.155	0.952	1.523
0.92	0.180	0.157	0.426	0.346	-.083	-.371	0.218	0.961	1.426
0.94	0.180	0.165	0.326	0.451	-.089	-.269	0.315	0.971	1.331
0.96	0.180	0.171	0.225	0.606	-.094	-.167	0.491	0.980	1.236
0.98	0.180	0.174	0.122	0.820	-.096	-.063	0.837	0.990	1.142
1.00	0.180	0.176	0.017	0.995	-.096	0.042	0.915	0.999	1.049
1.02	0.180	0.175	-.088	0.893	-.094	0.149	0.532	1.008	0.956
1.04	0.180	0.173	-.196	0.662	-.090	0.258	0.329	1.018	0.863
1.06	0.180	0.168	-.304	0.482	-.083	0.368	0.221	1.027	0.771
1.08	0.180	0.161	-.415	0.361	-.075	0.479	0.154	1.036	0.680
1.10	0.180	0.152	-.527	0.276	-.064	0.592	0.108	1.045	0.589

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.166	0.520	0.305	-.094	-.465	0.197	0.952	1.520
0.92	0.200	0.177	0.420	0.388	-.103	-.364	0.271	0.962	1.424
0.94	0.200	0.185	0.320	0.500	-.109	-.263	0.383	0.971	1.329
0.96	0.200	0.190	0.218	0.657	-.114	-.161	0.577	0.981	1.235
0.98	0.200	0.194	0.115	0.860	-.115	-.056	0.898	0.990	1.141
1.00	0.200	0.195	0.011	0.998	-.115	0.049	0.920	0.999	1.048
1.02	0.200	0.194	-.095	0.898	-.113	0.156	0.587	1.008	0.955
1.04	0.200	0.192	-.203	0.687	-.109	0.265	0.380	1.018	0.863
1.06	0.200	0.187	-.312	0.514	-.102	0.375	0.263	1.027	0.771
1.08	0.200	0.179	-.422	0.391	-.094	0.487	0.189	1.036	0.680
1.10	0.200	0.170	-.535	0.303	-.083	0.600	0.137	1.045	0.590

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	-.017	0.568	0.029	0.091	-.511	0.176	0.949	1.547
0.92	0.020	-.005	0.472	0.011	0.081	-.415	0.191	0.959	1.451
0.94	0.020	0.004	0.372	0.012	0.072	-.315	0.224	0.969	1.354
0.96	0.020	0.011	0.271	0.042	0.066	-.213	0.298	0.978	1.257
0.98	0.020	0.016	0.169	0.095	0.063	-.110	0.496	0.988	1.160
1.00	0.020	0.019	0.065	0.275	0.061	-.005	0.996	0.998	1.065
1.02	0.020	0.019	-.040	0.428	0.062	0.101	0.524	1.007	0.969
1.04	0.020	0.017	-.146	0.115	0.065	0.208	0.297	1.017	0.875
1.06	0.020	0.013	-.254	0.051	0.070	0.316	0.215	1.026	0.780
1.08	0.020	0.007	-.363	0.018	0.077	0.426	0.178	1.035	0.686
1.10	0.020	-.001	-.474	0.003	0.086	0.538	0.158	1.045	0.592

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.004	0.562	0.007	0.071	-.506	0.138	0.950	1.543
0.92	0.040	0.015	0.467	0.033	0.060	-.410	0.146	0.959	1.448
0.94	0.040	0.025	0.367	0.067	0.052	-.309	0.166	0.969	1.350
0.96	0.040	0.032	0.266	0.118	0.046	-.208	0.218	0.979	1.254
0.98	0.040	0.036	0.163	0.216	0.043	-.104	0.378	0.988	1.157
1.00	0.040	0.039	0.060	0.543	0.041	0.000	1.000	0.998	1.062
1.02	0.040	0.039	-.045	0.646	0.042	0.106	0.368	1.007	0.967
1.04	0.040	0.037	-.152	0.235	0.045	0.213	0.207	1.017	0.872
1.06	0.040	0.033	-.260	0.124	0.050	0.322	0.154	1.026	0.778
1.08	0.040	0.026	-.369	0.071	0.057	0.432	0.132	1.036	0.684
1.10	0.040	0.018	-.480	0.037	0.067	0.543	0.122	1.045	0.591

TABLE B-I, cont.

ORIGINAL PAGE IS
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DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.025	0.557	0.044	0.050	-.501	0.099	0.950	1.540
0.92	0.060	0.036	0.461	0.077	0.040	-.404	0.099	0.960	1.444
0.94	0.060	0.045	0.362	0.123	0.032	-.304	0.105	0.969	1.347
0.96	0.060	0.052	0.260	0.194	0.026	-.202	0.128	0.979	1.251
0.98	0.060	0.056	0.158	0.336	0.023	-.099	0.222	0.989	1.155
1.00	0.060	0.058	0.054	0.734	0.021	0.006	0.965	0.998	1.059
1.02	0.060	0.058	-.051	0.752	0.022	0.112	0.196	1.008	0.965
1.04	0.060	0.056	-.158	0.337	0.025	0.219	0.115	1.017	0.870
1.06	0.060	0.052	-.266	0.192	0.031	0.328	0.093	1.026	0.776
1.08	0.060	0.046	-.375	0.121	0.038	0.438	0.086	1.036	0.683
1.10	0.060	0.037	-.486	0.077	0.047	0.550	0.086	1.045	0.589

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.045	0.552	0.081	0.030	-.496	0.060	0.950	1.536
0.92	0.080	0.056	0.456	0.122	0.020	-.399	0.049	0.960	1.441
0.94	0.080	0.065	0.356	0.180	0.012	-.298	0.039	0.970	1.344
0.96	0.080	0.072	0.255	0.271	0.006	-.197	0.031	0.979	1.248
0.98	0.080	0.076	0.152	0.447	0.003	-.093	0.029	0.989	1.152
1.00	0.080	0.078	0.048	0.850	0.002	0.011	0.142	0.998	1.057
1.02	0.080	0.078	-.057	0.808	0.003	0.118	0.022	1.008	0.963
1.04	0.080	0.076	-.164	0.421	0.006	0.225	0.026	1.017	0.868
1.06	0.080	0.072	-.272	0.255	0.011	0.334	0.033	1.027	0.775
1.08	0.080	0.065	-.381	0.168	0.019	0.444	0.042	1.036	0.681
1.10	0.080	0.057	-.492	0.114	0.028	0.556	0.051	1.045	0.588

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.066	0.547	0.119	0.009	-.490	0.019	0.951	1.533
0.92	0.100	0.077	0.450	0.168	-.001	-.393	0.002	0.960	1.438
0.94	0.100	0.085	0.351	0.236	-.008	-.293	0.029	0.970	1.341
0.96	0.100	0.092	0.249	0.346	-.014	-.191	0.073	0.979	1.245
0.98	0.100	0.096	0.147	0.548	-.017	-.087	0.192	0.989	1.150
1.00	0.100	0.098	0.042	0.918	-.018	0.017	0.722	0.998	1.055
1.02	0.100	0.098	-.063	0.841	-.017	0.124	0.136	1.008	0.961
1.04	0.100	0.095	-.170	0.490	-.014	0.231	0.059	1.017	0.867
1.06	0.100	0.091	-.278	0.311	-.008	0.340	0.024	1.027	0.773
1.08	0.100	0.084	-.388	0.213	-.001	0.451	0.001	1.036	0.680
1.10	0.100	0.076	-.499	0.150	0.009	0.563	0.016	1.045	0.587

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.086	0.545	0.155	-.011	-.489	0.022	0.951	1.533
0.92	0.120	0.097	0.445	0.212	-.021	-.388	0.054	0.961	1.435
0.94	0.120	0.105	0.345	0.292	-.028	-.287	0.099	0.970	1.338
0.96	0.120	0.112	0.243	0.417	-.034	-.185	0.179	0.980	1.243
0.98	0.120	0.116	0.141	0.635	-.037	-.081	0.411	0.989	1.148
1.00	0.120	0.118	0.036	0.955	-.038	0.023	0.849	0.997	1.053
1.02	0.120	0.117	-.069	0.861	-.036	0.130	0.270	1.008	0.959
1.04	0.120	0.115	-.176	0.546	-.033	0.238	0.138	1.017	0.865
1.06	0.120	0.110	-.285	0.361	-.027	0.347	0.079	1.027	0.772
1.08	0.120	0.104	-.395	0.254	-.020	0.457	0.043	1.036	0.679
1.10	0.120	0.095	-.506	0.184	-.010	0.570	0.018	1.045	0.587

TABLE B-I, cont.

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.105	0.539	0.192	-.031	-.483	0.064	0.951	1.530
0.92	0.140	0.117	0.439	0.257	-.041	-.382	0.106	0.961	1.432
0.94	0.140	0.125	0.339	0.347	-.048	-.281	0.169	0.970	1.336
0.96	0.140	0.131	-.237	0.464	-.053	-.179	0.286	0.990	1.241
0.98	0.140	0.135	0.135	0.709	-.057	-.075	0.600	0.989	1.146
1.00	0.140	0.137	0.030	0.976	-.057	0.030	0.888	0.999	1.052
1.02	0.140	0.137	-.075	0.876	-.056	0.136	0.380	1.008	0.958
1.04	0.140	0.134	-.183	0.592	-.052	0.244	0.209	1.018	0.864
1.06	0.140	0.129	-.291	0.406	-.047	0.353	0.131	1.027	0.771
1.08	0.140	0.122	-.401	0.292	-.039	0.464	0.083	1.036	0.679
1.10	0.140	0.114	-.513	0.216	-.029	0.577	0.050	1.045	0.587
SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.126	0.533	0.230	-.051	-.477	0.106	0.951	1.527
0.92	0.160	0.137	0.433	0.301	-.061	-.376	0.160	0.961	1.429
0.94	0.160	0.145	0.333	0.399	-.068	-.275	0.240	0.971	1.334
0.96	0.160	0.151	0.231	0.547	-.073	-.173	0.389	0.980	1.239
0.98	0.160	0.155	0.128	0.770	-.076	-.069	0.740	0.990	1.144
1.00	0.160	0.157	0.024	0.988	-.077	0.036	0.905	0.999	1.050
1.02	0.160	0.156	-.082	0.885	-.075	0.143	0.466	1.008	0.957
1.04	0.160	0.153	-.189	0.630	-.072	0.251	0.274	1.018	0.863
1.06	0.160	0.149	-.298	0.446	-.066	0.360	0.180	1.027	0.771
1.08	0.160	0.142	-.409	0.327	-.058	0.471	0.122	1.036	0.679
1.10	0.160	0.133	-.521	0.247	-.048	0.584	0.082	1.045	0.587
SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.146	0.528	0.267	-.071	-.471	0.149	0.952	1.524
0.92	0.180	0.157	0.427	0.344	-.081	-.370	0.213	0.961	1.427
0.94	0.180	0.165	0.327	0.450	-.088	-.269	0.310	0.971	1.332
0.96	0.180	0.171	0.225	0.604	-.093	-.167	0.487	0.980	1.237
0.98	0.180	0.174	0.122	0.819	-.096	-.063	0.835	0.990	1.143
1.00	0.180	0.176	0.018	0.995	-.096	0.042	0.915	0.999	1.049
1.02	0.180	0.175	-.089	0.893	-.094	0.149	0.535	1.008	0.956
1.04	0.180	0.173	-.196	0.660	-.091	0.257	0.332	1.018	0.863
1.06	0.180	0.168	-.305	0.481	-.085	0.367	0.225	1.027	0.771
1.08	0.180	0.161	-.416	0.360	-.077	0.479	0.156	1.036	0.679
1.10	0.180	0.151	-.528	0.275	-.067	0.592	0.112	1.045	0.588
SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.166	0.522	0.303	-.091	-.465	0.192	0.952	1.522
0.92	0.200	0.177	0.421	0.386	-.101	-.364	0.266	0.962	1.425
0.94	0.200	0.185	0.321	0.499	-.108	-.263	0.378	0.971	1.330
0.96	0.200	0.190	0.219	0.656	-.112	-.160	0.574	0.980	1.235
0.98	0.200	0.194	0.116	0.859	-.115	-.056	0.897	0.990	1.141
1.00	0.200	0.195	0.011	0.998	-.115	0.049	0.920	0.999	1.048
1.02	0.200	0.194	-.095	0.898	-.114	0.156	0.588	1.009	0.955
1.04	0.200	0.192	-.203	0.686	-.110	0.264	0.383	1.018	0.863
1.06	0.200	0.186	-.312	0.512	-.104	0.375	0.267	1.027	0.771
1.08	0.200	0.179	-.424	0.390	-.096	0.486	0.193	1.036	0.679
1.10	0.200	0.170	-.536	0.302	-.085	0.600	0.141	1.045	0.588

TABLE B-II

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE HEAVY LOAD CASE

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	-.089	0.941	0.094	0.751	-.445	0.860	0.910	1.945
0.92	0.020	-.067	0.852	0.079	0.743	-.345	0.907	0.919	1.846
0.94	0.020	-.048	0.760	0.063	0.739	-.242	0.950	0.929	1.747
0.96	0.020	-.031	0.668	0.047	0.737	-.139	0.985	0.939	1.650
0.98	0.020	-.017	0.573	0.030	0.737	-.033	0.999	0.949	1.555
1.00	0.020	-.006	0.478	0.012	0.740	0.073	0.995	0.958	1.458
1.02	0.020	0.004	0.382	0.009	0.746	0.180	0.972	0.968	1.363
1.04	0.020	0.011	0.284	0.038	0.753	0.289	0.934	0.977	1.269
1.06	0.020	0.016	0.185	0.084	0.763	0.399	0.886	0.986	1.175
1.08	0.020	0.018	0.085	0.213	0.775	0.510	0.835	0.996	1.083
1.10	0.020	0.019	-.017	0.749	0.789	0.623	0.785	1.005	0.990

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	-.067	0.936	0.072	0.730	-.439	0.857	0.910	1.939
0.92	0.040	-.046	0.847	0.054	0.723	-.339	0.905	0.920	1.841
0.94	0.040	-.027	0.755	0.036	0.718	-.236	0.950	0.930	1.742
0.96	0.040	-.010	0.662	0.016	0.717	-.133	0.985	0.939	1.645
0.98	0.040	0.003	0.568	0.006	0.717	-.028	0.999	0.949	1.549
1.00	0.040	0.015	0.473	0.031	0.720	0.079	0.994	0.959	1.454
1.02	0.040	0.024	0.376	0.064	0.726	0.186	0.969	0.968	1.359
1.04	0.040	0.031	0.278	0.110	0.733	0.295	0.928	0.977	1.265
1.06	0.040	0.036	0.179	0.196	0.743	0.405	0.878	0.987	1.172
1.08	0.040	0.038	0.079	0.437	0.755	0.516	0.826	0.996	1.079
1.10	0.040	0.039	-.023	0.863	0.770	0.629	0.774	1.005	0.987

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	-.046	0.931	0.049	0.709	-.433	0.853	0.911	1.933
0.92	0.060	-.024	0.841	0.029	0.702	-.333	0.904	0.920	1.836
0.94	0.060	-.006	0.750	0.008	0.698	-.230	0.950	0.930	1.738
0.96	0.060	0.010	0.657	0.016	0.696	-.126	0.984	0.940	1.641
0.98	0.060	0.024	0.562	0.043	0.697	-.021	1.000	0.950	1.545
1.00	0.060	0.035	0.467	0.075	0.701	0.085	0.993	0.959	1.450
1.02	0.060	0.044	0.370	0.119	0.706	0.192	0.965	0.968	1.355
1.04	0.060	0.051	0.272	0.184	0.714	0.301	0.921	0.978	1.262
1.06	0.060	0.056	0.173	0.306	0.724	0.411	0.869	0.987	1.169
1.08	0.060	0.058	0.073	0.624	0.736	0.523	0.815	0.996	1.077
1.10	0.060	0.059	-.029	0.898	0.750	0.635	0.763	1.006	0.985

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	-.024	0.925	0.026	0.688	-.427	0.850	0.911	1.928
0.92	0.080	-.003	0.836	0.004	0.682	-.327	0.902	0.921	1.831
0.94	0.080	0.015	0.744	0.020	0.678	-.224	0.949	0.931	1.733
0.96	0.080	0.031	0.651	0.048	0.676	-.120	0.985	0.940	1.636
0.98	0.080	0.045	0.557	0.080	0.677	-.015	1.000	0.950	1.541
1.00	0.080	0.056	0.461	0.120	0.681	0.091	0.991	0.959	1.446
1.02	0.080	0.064	0.364	0.174	0.686	0.199	0.961	0.969	1.352
1.04	0.080	0.071	0.266	0.258	0.694	0.308	0.914	0.978	1.259
1.06	0.080	0.076	0.167	0.412	0.704	0.418	0.860	0.987	1.166
1.08	0.080	0.078	0.067	0.760	0.716	0.529	0.804	0.997	1.074
1.10	0.080	0.078	-.035	0.913	0.731	0.642	0.751	1.006	0.982

TABLE B-II, cont.

ORIGINAL PAGE IS
OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	-.003	0.920	0.003	0.668	-.421	0.846	0.912	1.923
0.92	0.100	0.018	0.830	0.022	0.661	-.321	0.900	0.921	1.826
0.94	0.100	0.036	0.738	0.049	0.658	-.218	0.949	0.931	1.728
0.96	0.100	0.052	0.645	0.080	0.656	-.114	0.985	0.941	1.632
0.98	0.100	0.065	0.551	0.117	0.657	-.009	1.000	0.950	1.537
1.00	0.100	0.076	0.455	0.165	0.661	0.097	0.989	0.960	1.442
1.02	0.100	0.085	0.359	0.230	0.667	0.205	0.956	0.969	1.349
1.04	0.100	0.091	0.260	0.330	0.675	0.314	0.907	0.978	1.256
1.06	0.100	0.095	0.161	0.510	0.685	0.424	0.850	0.988	1.163
1.08	0.100	0.098	0.060	0.851	0.697	0.536	0.793	0.997	1.071
1.10	0.100	0.098	-.041	0.921	0.712	0.649	0.739	1.006	0.980

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.019	0.914	0.020	0.647	-.415	0.842	0.912	1.918
0.92	0.120	0.039	0.825	0.047	0.641	-.315	0.898	0.922	1.821
0.94	0.120	0.057	0.733	0.077	0.637	-.212	0.949	0.932	1.724
0.96	0.120	0.072	0.639	0.112	0.636	-.108	0.986	0.941	1.628
0.98	0.120	0.085	0.545	0.155	0.638	-.003	1.000	0.951	1.533
1.00	0.120	0.096	0.449	0.209	0.641	0.104	0.987	0.960	1.439
1.02	0.120	0.105	0.352	0.285	0.647	0.211	0.951	0.969	1.346
1.04	0.120	0.111	0.254	0.401	0.655	0.321	0.898	0.979	1.253
1.06	0.120	0.115	0.155	0.598	0.665	0.431	0.839	0.988	1.161
1.08	0.120	0.117	0.054	0.908	0.678	0.542	0.781	0.997	1.069
1.10	0.120	0.117	-.048	0.926	0.693	0.655	0.726	1.006	0.978

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.040	0.908	0.044	0.627	-.409	0.838	0.913	1.913
0.92	0.140	0.060	0.819	0.073	0.621	-.308	0.896	0.922	1.817
0.94	0.140	0.078	0.727	0.106	0.617	-.206	0.949	0.932	1.720
0.96	0.140	0.093	0.633	0.145	0.616	-.102	0.987	0.942	1.625
0.98	0.140	0.106	0.539	0.193	0.618	0.004	1.000	0.951	1.530
1.00	0.140	0.116	0.443	0.254	0.622	0.110	0.985	0.960	1.436
1.02	0.140	0.125	0.346	0.339	0.628	0.218	0.945	0.970	1.343
1.04	0.140	0.131	0.248	0.467	0.636	0.327	0.889	0.979	1.250
1.06	0.140	0.135	0.148	0.673	0.646	0.438	0.828	0.988	1.158
1.08	0.140	0.137	0.048	0.945	0.659	0.549	0.768	0.997	1.067
1.10	0.140	0.137	-.055	0.929	0.673	0.662	0.713	1.006	0.976

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.061	0.903	0.067	0.606	-.402	0.833	0.913	1.909
0.92	0.160	0.081	0.813	0.099	0.600	-.302	0.893	0.923	1.812
0.94	0.160	0.098	0.721	0.135	0.597	-.199	0.949	0.932	1.716
0.96	0.160	0.113	0.627	0.178	0.597	-.095	0.988	0.942	1.621
0.98	0.160	0.126	0.533	0.230	0.598	0.010	1.000	0.951	1.527
1.00	0.160	0.137	0.437	0.298	0.602	0.117	0.982	0.961	1.433
1.02	0.160	0.145	0.340	0.392	0.608	0.225	0.938	0.970	1.340
1.04	0.160	0.151	0.241	0.530	0.616	0.334	0.879	0.979	1.248
1.06	0.160	0.155	0.142	0.737	0.627	0.444	0.816	0.988	1.156
1.08	0.160	0.156	0.041	0.968	0.640	0.556	0.755	0.997	1.065
1.10	0.160	0.156	-.062	0.931	0.654	0.669	0.699	1.007	0.974

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.082	0.897	0.091	0.586	-.396	0.828	0.914	1.904
0.92	0.180	0.102	0.807	0.125	0.580	-.296	0.891	0.923	1.808
0.94	0.180	0.119	0.715	0.164	0.577	-.1[illegible]	0.949	0.933	1.712
0.96	0.180	0.134	0.621	0.210	0.577	-.0[illegible]	0.988	0.942	1.618
0.98	0.180	0.146	0.527	0.267	0.578	0.017	1.000	0.952	1.524
1.00	0.180	0.156	0.431	0.341	0.582	0.123	0.978	0.961	1.430
1.02	0.180	0.164	0.333	0.443	0.589	0.231	0.931	0.970	1.338
1.04	0.180	0.170	0.235	0.587	0.597	0.341	0.869	0.979	1.246
1.06	0.180	0.174	0.135	0.790	0.608	0.451	0.803	0.989	1.154
1.08	0.180	0.176	0.034	0.982	0.620	0.563	0.740	0.998	1.063
1.10	0.180	0.176	-.069	0.931	0.635	0.677	0.684	1.007	0.973

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.103	0.891	0.115	0.566	-.390	0.823	0.914	1.900
0.92	0.200	0.122	0.801	0.151	0.560	-.289	0.889	0.924	1.804
0.94	0.200	0.139	0.709	0.193	0.557	-.186	0.949	0.933	1.709
0.96	0.200	0.154	0.615	0.243	0.557	-.082	0.989	0.943	1.614
0.98	0.200	0.166	0.520	0.304	0.559	0.023	0.999	0.952	1.521
1.00	0.200	0.176	0.424	0.384	0.563	0.130	0.974	0.961	1.428
1.02	0.200	0.184	0.327	0.491	0.569	0.238	0.922	0.970	1.335
1.04	0.200	0.190	0.228	0.640	0.578	0.348	0.857	0.980	1.244
1.06	0.200	0.194	0.128	0.834	0.589	0.458	0.789	0.989	1.153
1.08	0.200	0.195	0.027	0.991	0.601	0.571	0.725	0.998	1.062
1.10	0.200	0.195	-.076	0.932	0.616	0.684	0.669	1.007	0.972

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	-.097	0.970	0.099	0.800	-.442	0.875	0.906	1.978
0.92	0.020	-.073	0.875	0.083	0.787	-.339	0.918	0.917	1.871
0.94	0.020	-.053	0.784	0.067	0.777	-.241	0.955	0.927	1.773
0.96	0.020	-.035	0.688	0.051	0.770	-.137	0.985	0.937	1.672
0.98	0.020	-.020	0.591	0.034	0.765	-.032	0.999	0.947	1.571
1.00	0.020	-.007	0.493	0.015	0.763	0.074	0.995	0.957	1.472
1.02	0.020	0.002	0.393	0.006	0.763	0.181	0.973	0.967	1.374
1.04	0.020	0.010	0.293	0.035	0.765	0.289	0.935	0.976	1.277
1.06	0.020	0.015	0.190	0.080	0.770	0.399	0.888	0.986	1.181
1.08	0.020	0.018	0.087	0.206	0.777	0.510	0.836	0.996	1.085
1.10	0.020	0.019	-.018	0.730	0.786	0.622	0.784	1.005	0.990

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	-.075	0.965	0.077	0.779	-.436	0.873	0.907	1.971
0.92	0.040	-.051	0.869	0.059	0.766	-.333	0.917	0.917	1.866
0.94	0.040	-.032	0.778	0.040	0.757	-.235	0.955	0.927	1.767
0.96	0.040	-.014	0.683	0.020	0.749	-.131	0.985	0.937	1.667
0.98	0.040	0.001	0.586	0.001	0.745	-.026	0.999	0.947	1.567
1.00	0.040	0.013	0.487	0.027	0.743	0.080	0.994	0.957	1.468
1.02	0.040	0.023	0.388	0.059	0.743	0.187	0.970	0.967	1.370
1.04	0.040	0.030	0.287	0.105	0.746	0.295	0.930	0.977	1.273
1.06	0.040	0.035	0.185	0.188	0.750	0.405	0.880	0.986	1.177
1.08	0.040	0.038	0.081	0.428	0.757	0.516	0.827	0.996	1.082
1.10	0.040	0.039	-.024	0.854	0.767	0.628	0.774	1.005	0.986

TABLE B-II, cont.

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	-.053	0.959	0.055	0.758	-.430	0.870	0.907	1.965
0.92	0.060	-.030	0.868	0.035	0.746	-.331	0.914	0.918	1.864
0.94	0.060	-.010	0.773	0.013	0.736	-.229	0.955	0.928	1.762
0.96	0.060	0.007	0.677	0.010	0.729	-.125	0.986	0.938	1.662
0.98	0.060	0.022	0.580	0.037	0.725	-.020	1.000	0.948	1.562
1.00	0.060	0.034	0.481	0.070	0.722	0.086	0.993	0.958	1.464
1.02	0.060	0.043	0.382	0.113	0.723	0.193	0.966	0.967	1.366
1.04	0.060	0.051	0.281	0.178	0.726	0.301	0.924	0.977	1.270
1.06	0.060	0.056	0.179	0.297	0.731	0.411	0.872	0.987	1.174
1.08	0.060	0.058	0.075	0.613	0.738	0.522	0.816	0.996	1.078
1.10	0.060	0.059	-.030	0.891	0.747	0.634	0.762	1.006	0.984

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	-.031	0.954	0.033	0.737	-.424	0.867	0.908	1.960
0.92	0.080	-.009	0.862	0.011	0.725	-.325	0.913	0.918	1.859
0.94	0.080	0.011	0.767	0.014	0.716	-.223	0.955	0.928	1.757
0.96	0.080	0.028	0.671	0.041	0.709	-.119	0.986	0.938	1.657
0.98	0.080	0.042	0.574	0.074	0.704	-.014	1.000	0.948	1.558
1.00	0.080	0.054	0.476	0.113	0.703	0.092	0.992	0.958	1.460
1.02	0.080	0.064	0.376	0.167	0.703	0.199	0.962	0.968	1.363
1.04	0.080	0.071	0.275	0.249	0.706	0.308	0.917	0.977	1.266
1.06	0.080	0.075	0.172	0.401	0.711	0.417	0.862	0.987	1.171
1.08	0.080	0.078	0.069	0.750	0.718	0.528	0.806	0.996	1.076
1.10	0.080	0.078	-.036	0.908	0.728	0.641	0.751	1.006	0.981

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	-.010	0.948	0.010	0.716	-.418	0.864	0.909	1.954
0.92	0.100	0.012	0.856	0.014	0.704	-.319	0.911	0.919	1.854
0.94	0.100	0.032	0.761	0.042	0.695	-.216	0.955	0.929	1.753
0.96	0.100	0.049	0.665	0.073	0.688	-.113	0.987	0.939	1.653
0.98	0.100	0.063	0.568	0.110	0.684	-.008	1.000	0.949	1.554
1.00	0.100	0.075	0.470	0.157	0.682	0.098	0.790	0.958	1.456
1.02	0.100	0.084	0.370	0.221	0.683	0.206	0.958	0.968	1.359
1.04	0.100	0.091	0.269	0.320	0.686	0.314	0.909	0.978	1.263
1.06	0.100	0.095	0.166	0.498	0.691	0.424	0.853	0.987	1.168
1.08	0.100	0.098	0.062	0.843	0.699	0.535	0.794	0.997	1.073
1.10	0.100	0.098	-.043	0.917	0.708	0.647	0.738	1.006	0.979

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.012	0.942	0.012	0.695	-.412	0.860	0.909	1.949
0.92	0.120	0.034	0.850	0.039	0.683	-.313	0.909	0.919	1.849
0.94	0.120	0.053	0.755	0.069	0.675	-.210	0.955	0.929	1.748
0.96	0.120	0.069	0.659	0.105	0.668	-.106	0.988	0.939	1.649
0.98	0.120	0.083	0.562	0.147	0.664	-.001	1.000	0.949	1.550
1.00	0.120	0.095	0.463	0.201	0.662	0.105	0.988	0.959	1.453
1.02	0.120	0.104	0.363	0.275	0.663	0.212	0.953	0.968	1.356
1.04	0.120	0.111	0.262	0.389	0.667	0.321	0.901	0.978	1.260
1.06	0.120	0.115	0.160	0.584	0.672	0.431	0.842	0.987	1.165
1.08	0.120	0.117	0.056	0.903	0.679	0.542	0.782	0.997	1.071
1.10	0.120	0.117	-.049	0.922	0.689	0.654	0.725	1.006	0.977

DATA FOR SYNCHRONOUS MACHINE, CONSTANT VOLTAGE HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.033	0.936	0.035	0.674	-.406	0.857	0.910	1.944
0.92	0.140	0.055	0.844	0.065	0.663	-.306	0.908	0.920	1.844
0.94	0.140	0.074	0.749	0.098	0.654	-.204	0.955	0.930	1.744
0.96	0.140	0.090	0.653	0.136	0.648	-.100	0.988	0.940	1.645
0.98	0.140	0.104	0.556	0.183	0.644	0.005	1.000	0.949	1.547
1.00	0.140	0.115	0.457	0.244	0.643	0.111	0.985	0.959	1.449
1.02	0.140	0.124	0.357	0.328	0.644	0.219	0.947	0.969	1.353
1.04	0.140	0.130	0.256	0.454	0.647	0.327	0.892	0.978	1.258
1.06	0.140	0.135	0.153	0.661	0.652	0.437	0.831	0.988	1.163
1.08	0.140	0.137	0.049	0.941	0.660	0.549	0.769	0.997	1.068
1.10	0.140	0.137	-.056	0.925	0.670	0.661	0.712	1.007	0.975

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.054	0.930	0.059	0.653	-.400	0.853	0.910	1.939
0.92	0.160	0.075	0.838	0.090	0.643	-.300	0.906	0.920	1.839
0.94	0.160	0.094	0.743	0.126	0.634	-.197	0.955	0.930	1.740
0.96	0.160	0.110	0.647	0.168	0.628	-.094	0.989	0.940	1.641
0.98	0.160	0.124	0.550	0.220	0.624	0.012	1.000	0.950	1.543
1.00	0.160	0.135	0.451	0.287	0.623	0.118	0.983	0.959	1.446
1.02	0.160	0.144	0.351	0.379	0.624	0.225	0.941	0.969	1.350
1.04	0.160	0.150	0.249	0.516	0.628	0.334	0.883	0.978	1.255
1.06	0.160	0.155	0.146	0.726	0.633	0.444	0.819	0.988	1.161
1.08	0.160	0.156	0.042	0.965	0.641	0.556	0.756	0.997	1.067
1.10	0.160	0.156	-.063	0.927	0.651	0.668	0.698	1.007	0.973

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.076	0.924	0.081	0.633	-.393	0.849	0.911	1.934
0.92	0.180	0.096	0.832	0.115	0.622	-.293	0.904	0.921	1.835
0.94	0.180	0.115	0.737	0.154	0.613	-.191	0.955	0.930	1.736
0.96	0.180	0.131	0.641	0.200	0.608	-.087	0.990	0.940	1.637
0.98	0.180	0.144	0.543	0.257	0.604	0.018	1.000	0.950	1.540
1.00	0.180	0.155	0.444	0.329	0.603	0.124	0.979	0.960	1.443
1.02	0.180	0.164	0.344	0.429	0.605	0.232	0.934	0.969	1.348
1.04	0.180	0.170	0.243	0.574	0.608	0.341	0.872	0.979	1.253
1.06	0.180	0.174	0.140	0.780	0.614	0.451	0.806	0.988	1.159
1.08	0.180	0.176	0.035	0.980	0.622	0.563	0.741	0.998	1.065
1.10	0.180	0.176	-.070	0.929	0.632	0.676	0.683	1.007	0.972

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.097	0.918	0.105	0.612	-.387	0.845	0.911	1.930
0.92	0.200	0.117	0.826	0.141	0.602	-.287	0.903	0.921	1.831
0.94	0.200	0.135	0.731	0.182	0.593	-.184	0.955	0.931	1.732
0.96	0.200	0.151	0.634	0.232	0.588	-.080	0.991	0.941	1.634
0.98	0.200	0.164	0.537	0.293	0.584	0.025	0.999	0.950	1.537
1.00	0.200	0.175	0.438	0.371	0.584	0.131	0.976	0.960	1.441
1.02	0.200	0.183	0.337	0.477	0.585	0.239	0.926	0.969	1.345
1.04	0.200	0.190	0.236	0.627	0.589	0.348	0.861	0.979	1.251
1.06	0.200	0.193	0.133	0.825	0.594	0.458	0.792	0.988	1.157
1.08	0.200	0.195	0.028	0.990	0.602	0.570	0.726	0.998	1.063
1.10	0.200	0.195	-.077	0.929	0.613	0.683	0.668	1.007	0.970

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
LIGHT LOAD CASE

ORIGINAL PAGE IS OF POOR QUALITY

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.019	-.009	0.908	0.044	0.057	0.618	0.892	0.885
0.92	0.020	0.020	-.009	0.912	0.046	0.059	0.619	0.911	0.906
0.94	0.020	0.020	-.009	0.908	0.049	0.061	0.627	0.931	0.923
0.96	0.020	0.020	-.009	0.904	0.052	0.064	0.635	0.951	0.944
0.98	0.020	0.021	-.010	0.908	0.055	0.066	0.636	0.971	0.964
1.00	0.020	0.020	-.010	0.896	0.059	0.069	0.649	0.991	0.986
1.02	0.020	0.021	-.010	0.901	0.061	0.071	0.650	1.011	1.000
1.04	0.020	0.020	-.010	0.888	0.065	0.074	0.661	1.030	1.022
1.06	0.020	0.021	-.010	0.892	0.068	0.077	0.662	1.050	1.044
1.08	0.020	0.020	-.011	0.880	0.072	0.079	0.672	1.070	1.061
1.10	0.020	0.020	-.011	0.884	0.075	0.082	0.672	1.090	1.081

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.039	-.009	0.975	0.025	0.057	0.400	0.893	0.889
0.92	0.040	0.040	-.009	0.975	0.027	0.059	0.412	0.912	0.907
0.94	0.040	0.040	-.009	0.974	0.030	0.061	0.434	0.932	0.926
0.96	0.040	0.040	-.009	0.973	0.033	0.064	0.455	0.952	0.947
0.98	0.040	0.040	-.010	0.972	0.036	0.066	0.474	0.972	0.968
1.00	0.040	0.040	-.010	0.970	0.039	0.069	0.492	0.991	0.989
1.02	0.040	0.040	-.010	0.969	0.042	0.071	0.508	1.011	1.006
1.04	0.040	0.040	-.010	0.968	0.045	0.074	0.523	1.031	1.025
1.06	0.040	0.040	-.010	0.967	0.049	0.077	0.536	1.051	1.045
1.08	0.040	0.040	-.011	0.966	0.052	0.079	0.549	1.071	1.064
1.10	0.040	0.040	-.011	0.964	0.056	0.082	0.560	1.090	1.084

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.059	-.009	0.989	0.005	0.057	0.090	0.893	0.893
0.92	0.060	0.060	-.009	0.989	0.007	0.059	0.117	0.913	0.910
0.94	0.060	0.060	-.009	0.988	0.010	0.062	0.158	0.933	0.930
0.96	0.060	0.060	-.010	0.988	0.013	0.064	0.198	0.953	0.951
0.98	0.060	0.060	-.010	0.987	0.016	0.066	0.235	0.973	0.973
1.00	0.060	0.059	-.010	0.986	0.019	0.069	0.269	0.992	0.990
1.02	0.060	0.059	-.010	0.986	0.023	0.072	0.300	1.012	1.009
1.04	0.060	0.059	-.010	0.985	0.026	0.074	0.329	1.032	1.029
1.06	0.060	0.059	-.010	0.985	0.029	0.077	0.355	1.052	1.048
1.08	0.060	0.059	-.011	0.984	0.033	0.080	0.379	1.071	1.067
1.10	0.060	0.059	-.011	0.984	0.036	0.082	0.401	1.091	1.086

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.078	-.009	0.994	-.014	0.057	0.245	0.894	0.898
0.92	0.080	0.080	-.009	0.993	-.013	0.059	0.209	0.914	0.914
0.94	0.080	0.080	-.009	0.993	-.010	0.062	0.156	0.934	0.934
0.96	0.080	0.079	-.010	0.993	-.007	0.064	0.103	0.954	0.956
0.98	0.080	0.079	-.010	0.992	-.003	0.067	0.052	0.973	0.978
1.00	0.080	0.079	-.010	0.992	-.000	0.069	0.004	0.993	0.994
1.02	0.080	0.079	-.010	0.992	0.003	0.072	0.042	1.013	1.013
1.04	0.080	0.079	-.010	0.992	0.006	0.074	0.085	1.033	1.032
1.06	0.080	0.079	-.011	0.991	0.010	0.077	0.125	1.052	1.051
1.08	0.080	0.079	-.011	0.991	0.013	0.080	0.162	1.072	1.070
1.10	0.080	0.079	-.011	0.991	0.017	0.082	0.197	1.092	1.089

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.098	-.009	0.996	-.034	0.057	0.510	0.895	0.903
0.92	0.100	0.099	-.009	0.996	-.032	0.059	0.477	0.915	0.918
0.94	0.100	0.099	-.009	0.996	-.029	0.062	0.428	0.935	0.939
0.96	0.100	0.099	-.010	0.995	-.026	0.064	0.376	0.954	0.961
0.98	0.100	0.099	-.010	0.995	-.023	0.067	0.325	0.974	0.983
1.00	0.100	0.099	-.010	0.995	-.020	0.069	0.274	0.994	0.998
1.02	0.100	0.099	-.010	0.995	-.016	0.072	0.223	1.014	1.017
1.04	0.100	0.099	-.010	0.995	-.013	0.074	0.174	1.033	1.036
1.06	0.100	0.098	-.011	0.994	-.010	0.077	0.126	1.053	1.055
1.08	0.100	0.098	-.011	0.994	-.006	0.080	0.079	1.073	1.074
1.10	0.100	0.098	-.011	0.994	-.003	0.083	0.034	1.093	1.092

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.117	-.009	0.997	-.053	0.057	0.681	0.896	0.909
0.92	0.120	0.119	-.009	0.997	-.052	0.060	0.655	0.916	0.928
0.94	0.120	0.119	-.009	0.997	-.049	0.062	0.618	0.935	0.944
0.96	0.120	0.118	-.010	0.997	-.045	0.064	0.577	0.955	0.967
0.98	0.120	0.118	-.010	0.997	-.042	0.067	0.535	0.975	0.984
1.00	0.120	0.118	-.010	0.996	-.039	0.069	0.491	0.995	1.003
1.02	0.120	0.118	-.010	0.996	-.036	0.072	0.445	1.014	1.022
1.04	0.120	0.118	-.010	0.996	-.032	0.075	0.399	1.034	1.040
1.06	0.120	0.118	-.011	0.996	-.029	0.077	0.353	1.054	1.059
1.08	0.120	0.118	-.011	0.996	-.026	0.080	0.306	1.073	1.077
1.10	0.120	0.119	-.011	0.996	-.023	0.083	0.273	1.093	1.101

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.137	-.009	0.998	-.073	0.057	0.784	0.897	0.915
0.92	0.140	0.138	-.009	0.998	-.071	0.060	0.765	0.917	0.934
0.94	0.140	0.138	-.009	0.998	-.068	0.062	0.738	0.936	0.950
0.96	0.140	0.138	-.010	0.998	-.065	0.065	0.709	0.956	0.973
0.98	0.140	0.138	-.010	0.997	-.062	0.067	0.677	0.976	0.990
1.00	0.140	0.138	-.010	0.997	-.058	0.070	0.643	0.995	1.008
1.02	0.140	0.138	-.010	0.997	-.055	0.072	0.607	1.015	1.027
1.04	0.140	0.137	-.010	0.997	-.052	0.075	0.570	1.035	1.045
1.06	0.140	0.137	-.011	0.997	-.048	0.077	0.530	1.054	1.063
1.08	0.140	0.139	-.011	0.997	-.046	0.080	0.500	1.074	1.086
1.10	0.140	0.139	-.011	0.997	-.043	0.083	0.462	1.094	1.106

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.156	-.009	0.998	-.092	0.058	0.847	0.898	0.922
0.92	0.160	0.158	-.009	0.998	-.090	0.060	0.833	0.917	0.940
0.94	0.160	0.157	-.010	0.998	-.087	0.062	0.814	0.937	0.956
0.96	0.160	0.157	-.010	0.998	-.084	0.065	0.792	0.957	0.979
0.98	0.160	0.157	-.010	0.998	-.081	0.067	0.769	0.976	0.995
1.00	0.160	0.157	-.010	0.998	-.078	0.070	0.744	0.996	1.014
1.02	0.160	0.157	-.010	0.998	-.074	0.072	0.717	1.016	1.032
1.04	0.160	0.157	-.010	0.998	-.071	0.075	0.688	1.035	1.050
1.06	0.160	0.158	-.011	0.998	-.069	0.078	0.664	1.055	1.071
1.08	0.160	0.158	-.011	0.998	-.066	0.080	0.634	1.075	1.091
1.10	0.160	0.158	-.011	0.998	-.063	0.083	0.602	1.095	1.111

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
LIGHT LOAD CASE

ORIGINAL PAGE IS OF POOR QUALITY

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.175	-.009	0.999	-.111	0.058	0.887	0.898	0.929
0.92	0.180	0.177	-.009	0.999	-.109	0.060	0.877	0.918	0.947
0.94	0.180	0.177	-.010	0.999	-.106	0.062	0.863	0.938	0.962
0.96	0.180	0.177	-.010	0.998	-.103	0.065	0.847	0.957	0.986
0.98	0.180	0.176	-.010	0.998	-.100	0.067	0.830	0.977	1.001
1.00	0.180	0.176	-.010	0.998	-.097	0.070	0.811	0.997	1.019
1.02	0.180	0.176	-.010	0.998	-.093	0.072	0.791	1.016	1.037
1.04	0.180	0.177	-.011	0.998	-.091	0.075	0.773	1.036	1.054
1.06	0.180	0.177	-.011	0.998	-.088	0.078	0.751	1.056	1.077
1.08	0.180	0.178	-.011	0.998	-.085	0.080	0.727	1.076	1.096
1.10	0.180	0.178	-.011	0.998	-.082	0.083	0.702	1.095	1.116

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.195	-.009	0.999	-.130	0.058	0.913	0.899	0.937
0.92	0.200	0.196	-.010	0.999	-.128	0.060	0.905	0.919	0.954
0.94	0.200	0.196	-.010	0.999	-.125	0.063	0.895	0.939	0.969
0.96	0.200	0.196	-.010	0.999	-.122	0.065	0.883	0.958	0.993
0.98	0.200	0.196	-.010	0.999	-.119	0.067	0.870	0.978	1.008
1.00	0.200	0.195	-.010	0.999	-.116	0.070	0.856	0.998	1.025
1.02	0.200	0.196	-.010	0.999	-.114	0.073	0.843	1.017	1.042
1.04	0.200	0.197	-.011	0.999	-.111	0.075	0.827	1.037	1.063
1.06	0.200	0.197	-.011	0.998	-.108	0.078	0.810	1.057	1.082
1.08	0.200	0.197	-.011	0.998	-.105	0.081	0.792	1.076	1.101
1.10	0.200	0.198	-.011	0.998	-.101	0.083	0.773	1.096	1.121

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.019	-.009	0.908	0.050	0.060	0.635	0.891	0.884
0.92	0.020	0.019	-.009	0.905	0.052	0.062	0.638	0.911	0.905
0.94	0.020	0.019	-.009	0.904	0.053	0.064	0.641	0.931	0.924
0.96	0.020	0.020	-.009	0.901	0.055	0.066	0.644	0.951	0.945
0.98	0.020	0.020	-.010	0.899	0.057	0.067	0.647	0.971	0.962
1.00	0.020	0.020	-.010	0.896	0.059	0.069	0.650	0.991	0.983
1.02	0.020	0.020	-.010	0.894	0.061	0.071	0.653	1.011	1.001
1.04	0.020	0.020	-.010	0.890	0.063	0.073	0.656	1.030	1.023
1.06	0.020	0.020	-.010	0.887	0.065	0.074	0.659	1.050	1.044
1.08	0.020	0.020	-.011	0.884	0.067	0.076	0.662	1.070	1.066
1.10	0.020	0.020	-.011	0.881	0.069	0.078	0.665	1.090	1.081

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.039	-.009	0.975	0.030	0.061	0.443	0.892	0.888
0.92	0.040	0.040	-.009	0.975	0.031	0.062	0.444	0.912	0.909
0.94	0.040	0.040	-.009	0.974	0.033	0.064	0.459	0.932	0.926
0.96	0.040	0.040	-.009	0.973	0.035	0.066	0.472	0.952	0.947
0.98	0.040	0.040	-.010	0.972	0.037	0.067	0.483	0.972	0.967
1.00	0.040	0.041	-.010	0.972	0.038	0.069	0.485	0.991	0.986
1.02	0.040	0.040	-.010	0.969	0.042	0.071	0.505	1.011	1.006
1.04	0.040	0.041	-.010	0.969	0.043	0.073	0.507	1.031	1.027
1.06	0.040	0.040	-.010	0.967	0.046	0.074	0.524	1.051	1.045
1.08	0.040	0.040	-.011	0.967	0.047	0.076	0.525	1.071	1.069
1.10	0.040	0.040	-.011	0.964	0.050	0.078	0.540	1.091	1.084

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.059	-.009	0.989	0.010	0.061	0.167	0.893	0.892
0.92	0.060	0.060	-.009	0.989	0.011	0.062	0.179	0.913	0.910
0.94	0.060	0.060	-.009	0.988	0.013	0.064	0.204	0.933	0.930
0.96	0.060	0.060	-.010	0.988	0.015	0.066	0.228	0.952	0.951
0.98	0.060	0.060	-.010	0.987	0.018	0.068	0.251	0.972	0.972
1.00	0.060	0.060	-.010	0.986	0.020	0.069	0.273	0.992	0.993
1.02	0.060	0.059	-.010	0.986	0.022	0.071	0.293	1.012	1.014
1.04	0.060	0.059	-.010	0.985	0.024	0.073	0.312	1.032	1.029
1.06	0.060	0.059	-.010	0.985	0.026	0.075	0.329	1.052	1.049
1.08	0.060	0.059	-.011	0.984	0.028	0.076	0.346	1.072	1.068
1.10	0.060	0.059	-.011	0.984	0.030	0.078	0.362	1.092	1.088

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.078	-.009	0.994	-.009	0.061	0.151	0.894	0.897
0.92	0.080	0.079	-.009	0.993	-.008	0.062	0.132	0.914	0.914
0.94	0.080	0.079	-.009	0.993	-.006	0.064	0.098	0.933	0.934
0.96	0.080	0.079	-.010	0.993	-.004	0.066	0.063	0.953	0.955
0.98	0.080	0.079	-.010	0.992	-.002	0.068	0.030	0.973	0.977
1.00	0.080	0.079	-.010	0.992	0.000	0.069	0.001	0.993	0.998
1.02	0.080	0.079	-.010	0.992	0.002	0.071	0.031	1.013	1.013
1.04	0.080	0.079	-.010	0.992	0.004	0.073	0.059	1.033	1.033
1.06	0.080	0.079	-.011	0.991	0.006	0.075	0.086	1.053	1.052
1.08	0.080	0.079	-.011	0.991	0.009	0.076	0.112	1.073	1.071
1.10	0.080	0.079	-.011	0.991	0.011	0.078	0.137	1.092	1.091

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.098	-.009	0.996	-.029	0.061	0.427	0.894	0.903
0.92	0.100	0.099	-.009	0.996	-.028	0.063	0.407	0.914	0.918
0.94	0.100	0.099	-.009	0.996	-.026	0.064	0.373	0.934	0.938
0.96	0.100	0.099	-.010	0.995	-.024	0.066	0.338	0.954	0.960
0.98	0.100	0.099	-.010	0.995	-.022	0.068	0.303	0.974	0.982
1.00	0.100	0.099	-.010	0.995	-.019	0.070	0.269	0.994	0.999
1.02	0.100	0.099	-.010	0.995	-.017	0.071	0.236	1.014	1.018
1.04	0.100	0.099	-.010	0.995	-.015	0.073	0.203	1.034	1.037
1.06	0.100	0.099	-.011	0.994	-.013	0.075	0.171	1.053	1.056
1.08	0.100	0.099	-.011	0.994	-.011	0.077	0.141	1.073	1.075
1.10	0.100	0.098	-.011	0.994	-.009	0.078	0.110	1.093	1.094

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.117	-.009	0.997	-.048	0.061	0.619	0.895	0.909
0.92	0.120	0.119	-.009	0.997	-.047	0.063	0.602	0.915	0.927
0.94	0.120	0.119	-.009	0.997	-.045	0.064	0.575	0.935	0.943
0.96	0.120	0.118	-.010	0.997	-.043	0.066	0.546	0.955	0.965
0.98	0.120	0.118	-.010	0.997	-.041	0.068	0.517	0.975	0.988
1.00	0.120	0.118	-.010	0.996	-.039	0.070	0.487	0.995	1.003
1.02	0.120	0.118	-.010	0.996	-.037	0.071	0.457	1.014	1.022
1.04	0.120	0.118	-.010	0.996	-.035	0.073	0.427	1.034	1.041
1.06	0.120	0.118	-.011	0.996	-.032	0.075	0.397	1.054	1.060
1.08	0.120	0.118	-.011	0.996	-.030	0.077	0.367	1.074	1.079
1.10	0.120	0.118	-.011	0.996	-.028	0.078	0.337	1.094	1.097

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.137	-.009	0.998	-.067	0.061	0.741	0.896	0.915
0.92	0.140	0.138	-.009	0.998	-.067	0.063	0.728	0.916	0.933
0.94	0.140	0.138	-.009	0.998	-.065	0.065	0.708	0.936	0.949
0.96	0.140	0.138	-.010	0.998	-.063	0.066	0.686	0.956	0.971
0.98	0.140	0.138	-.010	0.997	-.060	0.068	0.664	0.975	0.994
1.00	0.140	0.138	-.010	0.997	-.058	0.070	0.641	0.995	1.008
1.02	0.140	0.138	-.010	0.997	-.056	0.071	0.617	1.015	1.027
1.04	0.140	0.138	-.010	0.997	-.054	0.073	0.593	1.035	1.046
1.06	0.140	0.137	-.011	0.997	-.052	0.075	0.568	1.055	1.064
1.08	0.140	0.137	-.011	0.997	-.050	0.077	0.543	1.075	1.083
1.10	0.140	0.139	-.011	0.997	-.049	0.079	0.527	1.095	1.105

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.156	-.009	0.998	-.087	0.061	0.817	0.897	0.922
0.92	0.160	0.157	-.009	0.998	-.086	0.063	0.807	0.917	0.940
0.94	0.160	0.157	-.010	0.998	-.084	0.065	0.792	0.937	0.955
0.96	0.160	0.157	-.010	0.998	-.082	0.066	0.776	0.956	0.977
0.98	0.160	0.157	-.010	0.998	-.080	0.068	0.760	0.976	0.995
1.00	0.160	0.157	-.010	0.998	-.077	0.070	0.743	0.996	1.014
1.02	0.160	0.157	-.010	0.998	-.075	0.072	0.725	1.016	1.032
1.04	0.160	0.157	-.011	0.998	-.073	0.073	0.706	1.036	1.051
1.06	0.160	0.157	-.011	0.998	-.071	0.075	0.687	1.056	1.069
1.08	0.160	0.158	-.011	0.998	-.070	0.077	0.674	1.075	1.091
1.10	0.160	0.158	-.011	0.998	-.068	0.079	0.656	1.095	1.111

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.175	-.009	0.999	-.106	0.061	0.865	0.898	0.929
0.92	0.180	0.177	-.009	0.999	-.105	0.063	0.858	0.918	0.946
0.94	0.180	0.177	-.010	0.999	-.103	0.065	0.847	0.937	0.961
0.96	0.180	0.177	-.010	0.998	-.101	0.067	0.835	0.957	0.984
0.98	0.180	0.176	-.010	0.998	-.099	0.068	0.823	0.977	1.001
1.00	0.180	0.176	-.010	0.998	-.097	0.070	0.810	0.997	1.019
1.02	0.180	0.176	-.010	0.998	-.094	0.072	0.797	1.017	1.038
1.04	0.180	0.176	-.011	0.998	-.092	0.073	0.783	1.036	1.056
1.06	0.180	0.177	-.011	0.998	-.091	0.075	0.773	1.056	1.077
1.08	0.180	0.178	-.011	0.998	-.090	0.077	0.759	1.076	1.096
1.10	0.180	0.178	-.011	0.998	-.088	0.079	0.745	1.096	1.116

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.195	-.009	0.999	-.125	0.062	0.897	0.899	0.936
0.92	0.200	0.196	-.010	0.999	-.124	0.063	0.891	0.918	0.953
0.94	0.200	0.196	-.010	0.999	-.122	0.065	0.883	0.938	0.972
0.96	0.200	0.196	-.010	0.999	-.120	0.067	0.874	0.958	0.991
0.98	0.200	0.196	-.010	0.999	-.118	0.068	0.865	0.978	1.008
1.00	0.200	0.195	-.010	0.999	-.116	0.070	0.855	0.998	1.025
1.02	0.200	0.195	-.010	0.999	-.114	0.072	0.845	1.017	1.043
1.04	0.200	0.197	-.011	0.999	-.113	0.074	0.838	1.037	1.060
1.06	0.200	0.197	-.011	0.998	-.111	0.075	0.827	1.057	1.082
1.08	0.200	0.197	-.011	0.998	-.109	0.077	0.817	1.077	1.102
1.10	0.200	0.197	-.011	0.998	-.107	0.079	0.806	1.097	1.121

TABLE B-IV

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
HEAVY LOAD CASE

CONSTANT IMPEDANCE LOAD

ORIGINAL PAGE IS OF POOR QUALITY

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.020	-.008	0.926	0.522	0.415	0.783	0.823	0.815
0.92	0.020	0.020	-.008	0.923	0.546	0.433	0.784	0.841	0.833
0.94	0.020	0.020	-.009	0.920	0.571	0.452	0.784	0.860	0.852
0.96	0.020	0.020	-.009	0.917	0.597	0.471	0.785	0.878	0.870
0.98	0.020	0.020	-.009	0.914	0.623	0.491	0.785	0.896	0.888
1.00	0.020	0.020	-.009	0.911	0.649	0.511	0.786	0.915	0.906
1.02	0.020	0.020	-.009	0.908	0.676	0.531	0.786	0.933	0.924
1.04	0.020	0.020	-.009	0.905	0.704	0.552	0.787	0.951	0.943
1.06	0.020	0.020	-.010	0.902	0.732	0.573	0.787	0.969	0.961
1.08	0.020	0.020	-.010	0.898	0.760	0.595	0.787	0.988	0.979
1.10	0.020	0.020	-.010	0.895	0.790	0.617	0.788	1.006	0.998

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.040	-.008	0.979	0.504	0.416	0.771	0.824	0.820
0.92	0.040	0.040	-.008	0.979	0.528	0.434	0.772	0.842	0.838
0.94	0.040	0.040	-.009	0.978	0.553	0.453	0.773	0.861	0.856
0.96	0.040	0.040	-.009	0.977	0.578	0.472	0.774	0.879	0.874
0.98	0.040	0.040	-.009	0.976	0.604	0.492	0.775	0.897	0.892
1.00	0.040	0.040	-.009	0.975	0.631	0.512	0.776	0.915	0.910
1.02	0.040	0.040	-.009	0.974	0.658	0.532	0.777	0.934	0.928
1.04	0.040	0.040	-.009	0.973	0.685	0.553	0.778	0.952	0.946
1.06	0.040	0.040	-.010	0.972	0.713	0.574	0.779	0.970	0.965
1.08	0.040	0.040	-.010	0.971	0.742	0.596	0.780	0.988	0.983
1.10	0.040	0.040	-.010	0.970	0.771	0.618	0.780	1.007	1.001

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.060	-.008	0.991	0.485	0.417	0.759	0.825	0.825
0.92	0.060	0.060	-.008	0.990	0.509	0.435	0.760	0.843	0.843
0.94	0.060	0.060	-.009	0.990	0.534	0.454	0.762	0.862	0.860
0.96	0.060	0.060	-.009	0.989	0.560	0.473	0.764	0.880	0.878
0.98	0.060	0.060	-.009	0.989	0.586	0.493	0.765	0.898	0.896
1.00	0.060	0.060	-.009	0.988	0.612	0.513	0.766	0.916	0.914
1.02	0.060	0.060	-.009	0.988	0.639	0.533	0.768	0.935	0.932
1.04	0.060	0.060	-.010	0.988	0.667	0.554	0.769	0.953	0.950
1.06	0.060	0.060	-.010	0.987	0.695	0.575	0.770	0.971	0.968
1.08	0.060	0.060	-.010	0.987	0.723	0.597	0.771	0.989	0.987
1.10	0.060	0.060	-.010	0.986	0.752	0.619	0.772	1.008	1.004

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.079	-.008	0.995	0.467	0.418	0.745	0.826	0.830
0.92	0.080	0.079	-.008	0.994	0.491	0.436	0.748	0.844	0.848
0.94	0.080	0.079	-.009	0.994	0.516	0.455	0.750	0.863	0.866
0.96	0.080	0.079	-.009	0.994	0.541	0.474	0.752	0.881	0.884
0.98	0.080	0.079	-.009	0.994	0.567	0.494	0.754	0.899	0.901
1.00	0.080	0.079	-.009	0.993	0.594	0.514	0.756	0.917	0.919
1.02	0.080	0.079	-.009	0.993	0.621	0.534	0.758	0.935	0.937
1.04	0.080	0.079	-.010	0.993	0.648	0.555	0.759	0.954	0.955
1.06	0.080	0.079	-.010	0.993	0.676	0.576	0.761	0.972	0.973
1.08	0.080	0.079	-.010	0.992	0.705	0.598	0.762	0.990	0.991
1.10	0.080	0.079	-.010	0.992	0.734	0.620	0.764	1.008	1.009

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.099	-.008	0.996	0.449	0.419	0.731	0.827	0.837
0.92	0.100	0.099	-.009	0.996	0.473	0.437	0.734	0.845	0.854
0.94	0.100	0.099	-.009	0.996	0.498	0.456	0.737	0.863	0.871
0.96	0.100	0.099	-.009	0.996	0.523	0.475	0.740	0.882	0.889
0.98	0.100	0.099	-.009	0.996	0.549	0.495	0.743	0.900	0.907
1.00	0.100	0.099	-.009	0.996	0.575	0.515	0.745	0.918	0.924
1.02	0.100	0.099	-.009	0.995	0.602	0.535	0.747	0.936	0.942
1.04	0.100	0.099	-.010	0.995	0.630	0.556	0.750	0.954	0.960
1.06	0.100	0.099	-.010	0.995	0.658	0.577	0.752	0.973	0.977
1.08	0.100	0.099	-.010	0.995	0.686	0.599	0.753	0.991	0.995
1.10	0.100	0.099	-.010	0.995	0.716	0.621	0.755	1.009	1.013

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.118	-.008	0.997	0.430	0.420	0.716	0.828	0.843
0.92	0.120	0.118	-.009	0.997	0.455	0.438	0.720	0.846	0.861
0.94	0.120	0.118	-.009	0.997	0.479	0.457	0.724	0.864	0.878
0.96	0.120	0.118	-.009	0.997	0.505	0.476	0.727	0.882	0.895
0.98	0.120	0.118	-.009	0.997	0.531	0.496	0.731	0.901	0.913
1.00	0.120	0.118	-.009	0.997	0.557	0.516	0.734	0.919	0.930
1.02	0.120	0.118	-.009	0.997	0.584	0.536	0.737	0.937	0.947
1.04	0.120	0.119	-.010	0.997	0.611	0.557	0.739	0.955	0.965
1.06	0.120	0.119	-.010	0.997	0.640	0.578	0.742	0.973	0.983
1.08	0.120	0.119	-.010	0.996	0.668	0.600	0.744	0.992	1.000
1.10	0.120	0.119	-.010	0.996	0.697	0.622	0.746	1.010	1.018

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.137	-.009	0.998	0.412	0.421	0.700	0.829	0.851
0.92	0.140	0.137	-.009	0.998	0.437	0.439	0.705	0.847	0.868
0.94	0.140	0.138	-.009	0.998	0.461	0.458	0.710	0.865	0.885
0.96	0.140	0.138	-.009	0.998	0.487	0.477	0.714	0.883	0.902
0.98	0.140	0.138	-.009	0.998	0.512	0.497	0.718	0.902	0.919
1.00	0.140	0.138	-.009	0.998	0.539	0.517	0.722	0.920	0.936
1.02	0.140	0.138	-.010	0.998	0.566	0.537	0.725	0.938	0.953
1.04	0.140	0.138	-.010	0.998	0.593	0.558	0.728	0.956	0.970
1.06	0.140	0.138	-.010	0.997	0.621	0.579	0.731	0.974	0.988
1.08	0.140	0.138	-.010	0.997	0.650	0.601	0.734	0.992	1.005
1.10	0.140	0.138	-.010	0.997	0.679	0.623	0.737	1.011	1.023

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.157	-.009	0.999	0.393	0.422	0.682	0.830	0.859
0.92	0.160	0.157	-.009	0.998	0.418	0.440	0.689	0.848	0.874
0.94	0.160	0.157	-.009	0.998	0.443	0.459	0.694	0.866	0.893
0.96	0.160	0.157	-.009	0.998	0.468	0.478	0.700	0.884	0.907
0.98	0.160	0.157	-.009	0.998	0.494	0.498	0.705	0.902	0.929
1.00	0.160	0.157	-.009	0.998	0.521	0.518	0.709	0.921	0.943
1.02	0.160	0.157	-.010	0.998	0.548	0.538	0.714	0.939	0.959
1.04	0.160	0.157	-.010	0.998	0.576	0.559	0.717	0.957	0.976
1.06	0.160	0.157	-.010	0.998	0.604	0.580	0.721	0.975	0.992
1.08	0.160	0.157	-.010	0.998	0.633	0.602	0.724	0.993	1.009
1.10	0.160	0.158	-.010	0.998	0.661	0.624	0.727	1.011	1.030

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.176	-.009	0.999	0.376	0.423	0.665	0.831	0.867
0.92	0.180	0.176	-.009	0.999	0.401	0.441	0.672	0.849	0.882
0.94	0.180	0.176	-.009	0.999	0.425	0.460	0.678	0.867	0.900
0.96	0.180	0.176	-.009	0.999	0.450	0.479	0.685	0.885	0.915
0.98	0.180	0.176	-.009	0.999	0.476	0.499	0.691	0.903	0.936
1.00	0.180	0.176	-.009	0.999	0.503	0.519	0.696	0.921	0.950
1.02	0.180	0.176	-.010	0.998	0.530	0.539	0.701	0.939	0.966
1.04	0.180	0.176	-.010	0.998	0.558	0.560	0.706	0.958	0.982
1.06	0.180	0.176	-.010	0.998	0.586	0.581	0.710	0.976	0.998
1.08	0.180	0.177	-.010	0.998	0.613	0.603	0.713	0.994	1.018
1.10	0.180	0.177	-.010	0.998	0.642	0.625	0.717	1.012	1.036

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.195	-.009	0.999	0.358	0.424	0.646	0.832	0.873
0.92	0.200	0.195	-.009	0.999	0.383	0.442	0.654	0.850	0.891
0.94	0.200	0.196	-.009	0.999	0.407	0.461	0.662	0.868	0.908
0.96	0.200	0.195	-.009	0.999	0.432	0.480	0.669	0.886	0.922
0.98	0.200	0.195	-.009	0.999	0.459	0.500	0.676	0.904	0.944
1.00	0.200	0.195	-.010	0.999	0.485	0.520	0.682	0.922	0.957
1.02	0.200	0.195	-.010	0.999	0.512	0.540	0.688	0.940	0.972
1.04	0.200	0.195	-.010	0.999	0.540	0.561	0.693	0.958	0.988
1.06	0.200	0.196	-.010	0.999	0.567	0.582	0.698	0.977	1.003
1.08	0.200	0.196	-.010	0.999	0.595	0.604	0.702	0.995	1.025
1.10	0.200	0.197	-.010	0.999	0.624	0.626	0.706	1.013	1.042

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.020	-.008	0.930	0.590	0.466	0.785	0.812	0.804
0.92	0.020	0.019	-.008	0.917	0.610	0.480	0.786	0.831	0.826
0.94	0.020	0.020	-.008	0.919	0.629	0.495	0.786	0.851	0.847
0.96	0.020	0.019	-.009	0.912	0.649	0.509	0.786	0.870	0.864
0.98	0.020	0.019	-.009	0.911	0.668	0.524	0.787	0.890	0.883
1.00	0.020	0.020	-.009	0.909	0.687	0.539	0.787	0.909	0.902
1.02	0.020	0.020	-.009	0.908	0.707	0.554	0.787	0.929	0.923
1.04	0.020	0.020	-.009	0.907	0.726	0.569	0.787	0.948	0.937
1.06	0.020	0.020	-.010	0.905	0.746	0.584	0.787	0.967	0.960
1.08	0.020	0.021	-.010	0.904	0.766	0.600	0.787	0.987	0.980
1.10	0.020	0.021	-.010	0.902	0.786	0.615	0.787	1.006	1.000

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.040	-.008	0.980	0.571	0.467	0.774	0.813	0.809
0.92	0.040	0.039	-.008	0.978	0.591	0.481	0.776	0.833	0.830
0.94	0.040	0.039	-.008	0.977	0.611	0.496	0.776	0.852	0.849
0.96	0.040	0.039	-.009	0.976	0.630	0.510	0.777	0.871	0.868
0.98	0.040	0.039	-.009	0.976	0.649	0.525	0.777	0.891	0.887
1.00	0.040	0.040	-.009	0.975	0.668	0.540	0.778	0.910	0.906
1.02	0.040	0.040	-.009	0.974	0.688	0.555	0.778	0.929	0.926
1.04	0.040	0.040	-.009	0.974	0.707	0.570	0.779	0.949	0.941
1.06	0.040	0.040	-.010	0.973	0.727	0.585	0.779	0.968	0.964
1.08	0.040	0.040	-.010	0.972	0.747	0.600	0.779	0.988	0.983
1.10	0.040	0.041	-.010	0.971	0.767	0.616	0.780	1.007	1.003

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.060	-.008	0.991	0.553	0.468	0.764	0.814	0.814
0.92	0.060	0.059	-.008	0.990	0.573	0.482	0.765	0.834	0.835
0.94	0.060	0.059	-.009	0.990	0.592	0.496	0.766	0.853	0.854
0.96	0.060	0.059	-.009	0.989	0.611	0.511	0.767	0.872	0.872
0.98	0.060	0.059	-.009	0.989	0.630	0.526	0.768	0.892	0.891
1.00	0.060	0.059	-.009	0.988	0.649	0.541	0.768	0.911	0.910
1.02	0.060	0.060	-.009	0.988	0.669	0.556	0.769	0.930	0.930
1.04	0.060	0.060	-.009	0.988	0.688	0.571	0.770	0.950	0.946
1.06	0.060	0.060	-.010	0.987	0.708	0.586	0.771	0.969	0.968
1.08	0.060	0.060	-.010	0.987	0.728	0.601	0.771	0.989	0.987
1.10	0.060	0.060	-.010	0.986	0.748	0.616	0.772	1.008	1.007

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.079	-.008	0.995	0.534	0.468	0.752	0.815	0.820
0.92	0.080	0.079	-.008	0.994	0.554	0.483	0.754	0.835	0.840
0.94	0.080	0.079	-.009	0.994	0.573	0.497	0.755	0.854	0.859
0.96	0.080	0.079	-.009	0.994	0.592	0.512	0.756	0.873	0.878
0.98	0.080	0.079	-.009	0.994	0.611	0.527	0.758	0.893	0.896
1.00	0.080	0.079	-.009	0.993	0.631	0.541	0.759	0.912	0.918
1.02	0.080	0.079	-.009	0.993	0.650	0.556	0.760	0.931	0.934
1.04	0.080	0.080	-.010	0.993	0.670	0.571	0.761	0.951	0.950
1.06	0.080	0.080	-.010	0.993	0.689	0.586	0.762	0.970	0.972
1.08	0.080	0.080	-.010	0.992	0.709	0.602	0.763	0.989	0.991
1.10	0.080	0.080	-.010	0.992	0.729	0.617	0.763	1.009	1.011

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.099	-.008	0.997	0.516	0.469	0.740	0.816	0.823
0.92	0.100	0.098	-.008	0.996	0.535	0.484	0.742	0.836	0.846
0.94	0.100	0.098	-.009	0.996	0.554	0.498	0.744	0.855	0.865
0.96	0.100	0.098	-.009	0.996	0.573	0.513	0.745	0.874	0.883
0.98	0.100	0.099	-.009	0.996	0.592	0.527	0.747	0.894	0.902
1.00	0.100	0.099	-.009	0.996	0.612	0.542	0.748	0.913	0.923
1.02	0.100	0.099	-.009	0.996	0.631	0.557	0.750	0.932	0.939
1.04	0.100	0.099	-.010	0.995	0.651	0.572	0.751	0.952	0.956
1.06	0.100	0.099	-.010	0.995	0.671	0.587	0.752	0.971	0.977
1.08	0.100	0.099	-.010	0.995	0.691	0.602	0.754	0.990	0.996
1.10	0.100	0.100	-.010	0.995	0.711	0.618	0.755	1.010	1.015

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.119	-.008	0.998	0.497	0.470	0.726	0.817	0.833
0.92	0.120	0.118	-.009	0.997	0.517	0.484	0.730	0.837	0.854
0.94	0.120	0.118	-.009	0.997	0.536	0.499	0.732	0.856	0.871
0.96	0.120	0.118	-.009	0.997	0.555	0.513	0.734	0.875	0.889
0.98	0.120	0.118	-.009	0.997	0.574	0.528	0.736	0.894	0.910
1.00	0.120	0.118	-.009	0.997	0.593	0.543	0.738	0.914	0.928
1.02	0.120	0.118	-.009	0.997	0.613	0.558	0.739	0.933	0.945
1.04	0.120	0.119	-.010	0.997	0.632	0.573	0.741	0.952	0.962
1.06	0.120	0.119	-.010	0.997	0.652	0.588	0.743	0.972	0.978
1.08	0.120	0.119	-.010	0.996	0.672	0.603	0.744	0.991	1.001
1.10	0.120	0.119	-.010	0.996	0.692	0.618	0.746	1.011	1.020

TABLE B-IV, cont.

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT REACTIVE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.138	-.008	0.998	0.479	0.471	0.713	0.818	0.841
0.92	0.140	0.137	-.009	0.998	0.498	0.485	0.716	0.838	0.862
0.94	0.140	0.137	-.009	0.998	0.517	0.500	0.719	0.857	0.878
0.96	0.140	0.137	-.009	0.998	0.536	0.514	0.722	0.876	0.898
0.98	0.140	0.138	-.009	0.998	0.555	0.529	0.724	0.895	0.915
1.00	0.140	0.138	-.009	0.998	0.575	0.544	0.726	0.915	0.933
1.02	0.140	0.138	-.010	0.998	0.594	0.559	0.729	0.934	0.950
1.04	0.140	0.138	-.010	0.998	0.614	0.574	0.731	0.953	0.968
1.06	0.140	0.138	-.010	0.997	0.633	0.589	0.733	0.973	0.985
1.08	0.140	0.138	-.010	0.997	0.653	0.604	0.734	0.992	1.002
1.10	0.140	0.138	-.010	0.997	0.673	0.619	0.736	1.011	1.025

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.157	-.008	0.999	0.461	0.472	0.699	0.819	0.849
0.92	0.160	0.157	-.009	0.998	0.479	0.486	0.702	0.839	0.870
0.94	0.160	0.157	-.009	0.998	0.499	0.500	0.706	0.858	0.882
0.96	0.160	0.157	-.009	0.998	0.518	0.515	0.709	0.877	0.903
0.98	0.160	0.157	-.009	0.998	0.537	0.530	0.712	0.896	0.922
1.00	0.160	0.157	-.009	0.998	0.557	0.544	0.715	0.916	0.939
1.02	0.160	0.156	-.010	0.998	0.577	0.559	0.718	0.935	0.957
1.04	0.160	0.157	-.010	0.998	0.595	0.574	0.720	0.954	0.973
1.06	0.160	0.157	-.010	0.998	0.616	0.589	0.723	0.973	0.992
1.08	0.160	0.158	-.010	0.998	0.635	0.605	0.724	0.993	1.012
1.10	0.160	0.157	-.010	0.998	0.656	0.620	0.727	1.012	1.030

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.176	-.009	0.999	0.443	0.472	0.684	0.820	0.858
0.92	0.180	0.176	-.009	0.999	0.461	0.487	0.688	0.839	0.875
0.94	0.180	0.176	-.009	0.999	0.480	0.501	0.692	0.859	0.890
0.96	0.180	0.176	-.009	0.999	0.499	0.516	0.696	0.878	0.908
0.98	0.180	0.177	-.009	0.999	0.518	0.530	0.699	0.897	0.929
1.00	0.180	0.176	-.009	0.999	0.538	0.545	0.702	0.916	0.945
1.02	0.180	0.177	-.010	0.999	0.557	0.560	0.705	0.936	0.963
1.04	0.180	0.177	-.010	0.998	0.577	0.575	0.708	0.955	0.981
1.06	0.180	0.177	-.010	0.998	0.597	0.590	0.711	0.974	0.998
1.08	0.180	0.177	-.010	0.998	0.617	0.605	0.714	0.994	1.014
1.10	0.180	0.176	-.010	0.998	0.637	0.620	0.716	1.013	1.036

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.195	-.009	0.999	0.425	0.473	0.668	0.821	0.867
0.92	0.200	0.195	-.009	0.999	0.443	0.487	0.673	0.840	0.884
0.94	0.200	0.195	-.009	0.999	0.462	0.502	0.677	0.860	0.901
0.96	0.200	0.195	-.009	0.999	0.481	0.516	0.682	0.879	0.914
0.98	0.200	0.195	-.009	0.999	0.500	0.531	0.686	0.898	0.933
1.00	0.200	0.195	-.010	0.999	0.520	0.546	0.690	0.917	0.952
1.02	0.200	0.196	-.010	0.999	0.539	0.561	0.693	0.937	0.970
1.04	0.200	0.197	-.010	0.999	0.558	0.576	0.696	0.956	0.988
1.06	0.200	0.196	-.010	0.999	0.578	0.591	0.700	0.975	1.008
1.08	0.200	0.196	-.010	0.999	0.598	0.606	0.702	0.994	1.021
1.10	0.200	0.197	-.010	0.999	0.618	0.621	0.705	1.014	1.042

TABLE B-V

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
LIGHT LOAD CASE

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.020	0.018	0.118	0.152	0.047	-.069	0.566	0.905	0.39
0.92	0.020	0.019	0.104	0.177	0.050	-.053	0.685	0.923	0.49
0.94	0.020	0.019	0.089	0.209	0.052	-.036	0.824	0.942	0.59
0.96	0.020	0.019	0.073	0.255	0.054	-.018	0.949	0.960	0.69
0.98	0.020	0.020	0.057	0.325	0.057	0.000	1.000	0.978	0.78
1.00	0.020	0.020	0.040	0.442	0.060	0.019	0.951	0.996	0.87
1.02	0.020	0.020	0.023	0.661	0.062	0.039	0.847	1.014	0.96
1.04	0.020	0.020	0.004	0.977	0.065	0.059	0.739	1.032	1.04
1.06	0.020	0.020	-.014	0.809	0.068	0.081	0.646	1.050	1.12
1.08	0.020	0.020	-.034	0.505	0.071	0.102	0.572	1.068	1.20
1.10	0.020	0.020	-.054	0.342	0.075	0.125	0.513	1.086	1.28

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.040	0.038	0.115	0.314	0.028	-.066	0.384	0.906	1.62
0.92	0.040	0.039	0.101	0.357	0.030	-.050	0.513	0.924	1.70
0.94	0.040	0.039	0.086	0.413	0.032	-.033	0.699	0.942	1.78
0.96	0.040	0.039	0.070	0.487	0.034	-.015	0.917	0.960	1.85
0.98	0.040	0.040	0.054	0.590	0.037	0.003	0.996	0.978	1.92
1.00	0.040	0.040	0.037	0.730	0.040	0.022	0.871	0.996	1.99
1.02	0.040	0.040	0.020	0.898	0.043	0.042	0.710	1.014	2.06
1.04	0.040	0.040	0.001	0.999	0.045	0.063	0.587	1.032	2.12
1.06	0.040	0.040	-.018	0.915	0.048	0.084	0.501	1.050	2.19
1.08	0.040	0.040	-.037	0.731	0.052	0.106	0.439	1.068	2.24
1.10	0.040	0.040	-.057	0.569	0.055	0.128	0.394	1.086	2.30

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.060	0.058	0.112	0.459	0.008	-.063	0.122	0.907	2.85
0.92	0.060	0.058	0.098	0.513	0.010	-.047	0.209	0.925	2.91
0.94	0.060	0.059	0.083	0.579	0.012	-.029	0.384	0.943	2.96
0.96	0.060	0.059	0.067	0.661	0.015	-.012	0.782	0.961	3.01
0.98	0.060	0.059	0.051	0.760	0.017	0.007	0.932	0.979	3.06
1.00	0.060	0.060	0.034	0.869	0.020	0.026	0.612	0.997	3.11
1.02	0.060	0.060	0.016	0.965	0.023	0.046	0.447	1.015	3.16
1.04	0.060	0.060	-.002	0.999	0.026	0.066	0.362	1.033	3.20
1.06	0.060	0.060	-.021	0.944	0.029	0.087	0.313	1.051	3.24
1.08	0.060	0.060	-.040	0.827	0.032	0.109	0.280	1.069	3.29
1.10	0.060	0.059	-.061	0.700	0.035	0.131	0.258	1.087	3.33

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.080	0.078	0.109	0.582	-.012	-.059	0.198	0.907	4.08
0.92	0.080	0.078	0.094	0.639	-.010	-.043	0.222	0.925	4.11
0.94	0.080	0.079	0.079	0.705	-.007	-.026	0.277	0.943	4.14
0.96	0.080	0.079	0.063	0.779	-.005	-.008	0.527	0.961	4.17
0.98	0.080	0.079	0.047	0.859	-.002	0.010	0.227	0.979	4.20
1.00	0.080	0.079	0.030	0.935	0.000	0.029	0.011	0.997	4.22
1.02	0.080	0.079	0.013	0.988	0.003	0.049	0.063	1.015	4.25
1.04	0.080	0.079	-.006	0.997	0.006	0.070	0.086	1.033	4.27
1.06	0.080	0.079	-.025	0.955	0.009	0.091	0.099	1.051	4.30
1.08	0.080	0.079	-.044	0.873	0.012	0.113	0.108	1.069	4.32
1.10	0.080	0.079	-.064	0.776	0.015	0.135	0.114	1.087	4.35

TABLE B-V, cont.

ORIGINAL PAGE IS
OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.100	0.097	0.105	0.681	-.032	-.055	0.496	0.907	5.30
0.92	0.100	0.098	0.090	0.735	-.029	-.039	0.603	0.925	5.3[illegible]
0.94	0.100	0.098	0.075	0.794	-.027	-.022	0.778	0.943	5.31
0.96	0.100	0.098	0.059	0.856	-.025	-.004	0.987	0.961	5.32
0.98	0.100	0.099	0.043	0.916	-.022	0.014	0.836	0.979	5.33
1.00	0.100	0.099	0.026	0.967	-.019	0.034	0.500	0.997	5.34
1.02	0.100	0.099	0.008	0.996	-.017	0.053	0.296	1.015	5.35
1.04	0.100	0.099	-.010	0.995	-.014	0.074	0.181	1.033	5.35
1.06	0.100	0.099	-.029	0.961	-.011	0.095	0.110	1.051	5.35
1.08	0.100	0.099	-.048	0.899	-.007	0.117	0.063	1.069	5.36
1.10	0.100	0.099	-.068	0.822	-.004	0.139	0.030	1.087	5.37

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.120	0.117	0.100	0.759	-.051	-.051	0.709	0.908	6.53
0.92	0.120	0.118	0.086	0.808	-.049	-.034	0.818	0.926	6.51
0.94	0.120	0.118	0.071	0.857	-.047	-.017	0.937	0.944	6.50
0.96	0.120	0.118	0.055	0.906	-.044	0.000	1.000	0.962	6.48
0.98	0.120	0.118	0.039	0.950	-.042	0.019	0.911	0.980	6.47
1.00	0.120	0.119	0.022	0.984	-.039	0.038	0.716	0.998	6.45
1.02	0.120	0.119	0.004	0.999	-.036	0.058	0.531	1.016	6.44
1.04	0.120	0.119	-.014	0.993	-.033	0.[illegible]78	0.391	1.034	6.43
1.06	0.120	0.119	-.033	0.963	-.030	0.099	0.291	1.052	6.42
1.08	0.120	0.119	-.053	0.914	-.027	0.121	0.218	1.070	6.40
1.10	0.120	0.118	-.073	0.852	-.024	0.144	0.163	1.088	6.39

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.140	0.137	0.096	0.819	-.071	-.046	0.837	0.908	7.75
0.92	0.140	0.137	0.081	0.860	-.069	-.030	0.917	0.926	7.71
0.94	0.14[illegible]	0.137	0.066	0.901	-.066	-.013	0.982	0.944	7.67
0.96	0.140	0.138	0.050	0.939	-.064	0.005	0.997	0.962	7.63
0.98	0.140	0.138	0.034	0.971	-.061	0.024	0.933	0.980	7.60
1.00	0.140	0.138	0.017	0.992	-.058	0.043	0.807	0.998	7.56
1.02	0.140	0.138	-.001	1.000	-.056	0.062	0.665	1.016	7.53
1.04	0.140	0.138	-.019	0.991	-.053	0.083	0.536	1.034	7.50
1.06	0.140	0.138	-.038	0.965	-.050	0.104	0.431	1.052	7.47
1.08	0.140	0.138	-.057	0.924	-.047	0.126	0.347	1.070	7.44
1.10	0.140	0.138	-.077	0.872	-.043	0.149	0.280	1.088	7.41

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.160	0.156	0.091	0.865	-.090	-.041	0.910	0.908	8.97
0.92	0.160	0.157	0.076	0.899	-.088	-.025	0.963	0.926	8.91
0.94	0.160	0.157	0.061	0.932	-.086	-.008	0.996	0.944	8.85
0.96	0.160	0.157	0.045	0.961	-.083	0.010	0.993	0.962	8.79
0.98	0.160	0.157	0.029	0.983	-.080	0.029	0.942	0.980	8.73
1.00	0.160	0.156	0.012	0.997	-.078	0.048	0.852	0.998	8.68
1.02	0.160	0.158	-.006	0.999	-.075	0.068	0.743	1.016	8.62
1.04	0.160	0.158	-.024	0.989	-.072	0.088	0.634	1.034	8.57
1.06	0.160	0.158	-.043	0.965	-.069	0.109	0.535	1.052	8.52
1.08	0.160	0.158	-.062	0.930	-.066	0.131	0.449	1.070	8.48
1.10	0.160	0.157	-.082	0.886	-.063	0.154	0.378	1.088	8.43

TABLE B-V, cont.

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.180	0.175	0.085	0.900	-.109	-.036	0.951	0.909	10.19
0.92	0.180	0.176	0.071	0.928	-.107	-.019	0.984	0.927	10.11
0.94	0.180	0.176	0.056	0.954	-.105	-.002	1.000	0.945	10.03
0.96	0.180	0.176	0.040	0.975	-.102	0.016	0.989	0.963	9.94
0.98	0.180	0.177	0.024	0.991	-.100	0.034	0.947	0.981	9.86
1.00	0.180	0.177	0.007	0.999	-.097	0.053	0.877	0.998	9.79
1.02	0.180	0.177	-.011	0.998	-.094	0.073	0.791	1.016	9.72
1.04	0.180	0.177	-.029	0.987	-.091	0.093	0.700	1.034	9.65
1.06	0.180	0.177	-.048	0.965	-.088	0.115	0.611	1.052	9.58
1.08	0.180	0.177	-.068	0.934	-.085	0.136	0.530	1.070	9.51
1.10	0.180	0.177	-.088	0.896	-.082	0.159	0.459	1.088	9.45

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.200	0.195	0.079	0.926	-.129	-.030	0.974	0.909	11.41
0.92	0.200	0.195	0.065	0.949	-.126	-.013	0.994	0.927	11.30
0.94	0.200	0.195	0.050	0.969	-.124	0.004	1.000	0.945	11.19
0.96	0.200	0.196	0.034	0.985	-.122	0.021	0.985	0.963	11.09
0.98	0.200	0.196	0.018	0.996	-.119	0.040	0.948	0.981	10.99
1.00	0.200	0.196	0.001	1.000	-.116	0.059	0.892	0.999	10.90
1.02	0.200	0.196	-.017	0.996	-.113	0.079	0.822	1.017	10.81
1.04	0.200	0.196	-.035	0.985	-.111	0.099	0.745	1.035	10.73
1.06	0.200	0.196	-.054	0.965	-.108	0.120	0.667	1.053	10.64
1.08	0.200	0.196	-.073	0.937	-.105	0.142	0.593	1.071	10.56
1.10	0.200	0.196	-.093	0.903	-.101	0.164	0.524	1.088	10.48

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.020	0.018	0.119	0.151	0.052	-.066	0.620	0.905	0.38
0.92	0.020	0.019	0.104	0.176	0.053	-.050	0.729	0.923	0.49
0.94	0.020	0.019	0.089	0.208	0.055	-.034	0.852	0.941	0.59
0.96	0.020	0.019	0.073	0.254	0.056	-.017	0.959	0.959	0.69
0.98	0.020	0.020	0.057	0.324	0.058	0.001	1.000	0.977	0.78
1.00	0.020	0.020	0.040	0.442	0.060	0.020	0.951	0.996	0.87
1.02	0.020	0.020	0.022	0.662	0.062	0.039	0.847	1.014	0.96
1.04	0.020	0.020	0.004	0.979	0.063	0.058	0.736	1.032	1.04
1.06	0.020	0.020	-.015	0.803	0.065	0.079	0.639	1.050	1.12
1.08	0.020	0.020	-.034	0.500	0.067	0.100	0.559	1.068	1.20
1.10	0.020	0.020	-.055	0.339	0.069	0.121	0.496	1.086	1.28

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.040	0.038	0.116	0.313	0.032	-.063	0.455	0.905	1.62
0.92	0.040	0.039	0.101	0.356	0.034	-.047	0.579	0.924	1.70
0.94	0.040	0.039	0.086	0.411	0.035	-.031	0.751	0.942	1.78
0.96	0.040	0.039	0.071	0.486	0.037	-.014	0.937	0.960	1.85
0.98	0.040	0.039	0.054	0.589	0.038	0.004	0.994	0.978	1.92
1.00	0.040	0.040	0.037	0.730	0.040	0.023	0.871	0.996	1.99
1.02	0.040	0.040	0.019	0.898	0.042	0.042	0.708	1.014	2.06
1.04	0.040	0.040	0.001	1.000	0.044	0.061	0.579	1.032	2.12
1.06	0.040	0.040	-.018	0.912	0.045	0.082	0.486	1.050	2.19
1.08	0.040	0.040	-.037	0.727	0.047	0.103	0.419	1.069	2.25
1.10	0.040	0.040	-.058	0.565	0.050	0.125	0.370	1.087	2.30

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.060	0.058	0.113	0.458	0.012	-.060	0.202	0.906	2.85
0.92	0.060	0.058	0.098	0.512	0.014	-.044	0.298	0.924	2.91
0.94	0.060	0.059	0.083	0.578	0.015	-.028	0.485	0.942	2.96
0.96	0.060	0.059	0.067	0.660	0.017	-.010	0.851	0.960	3.01
0.98	0.060	0.059	0.051	0.759	0.018	0.007	0.927	0.978	3.06
1.00	0.060	0.060	0.034	0.869	0.020	0.026	0.614	0.997	3.11
1.02	0.060	0.060	0.016	0.965	0.022	0.045	0.438	1.015	3.16
1.04	0.060	0.060	-.002	0.999	0.024	0.065	0.344	1.033	3.20
1.06	0.060	0.060	-.021	0.942	0.026	0.085	0.289	1.051	3.24
1.08	0.060	0.060	-.041	0.824	0.028	0.106	0.252	1.069	3.29
1.10	0.060	0.059	-.061	0.696	0.030	0.128	0.227	1.087	3.33

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.080	0.078	0.109	0.581	-.007	-.056	0.130	0.906	4.08
0.92	0.080	0.078	0.095	0.637	-.006	-.040	0.146	0.925	4.11
0.94	0.080	0.079	0.079	0.703	-.004	-.024	0.185	0.943	4.14
0.96	0.080	0.079	0.064	0.778	-.003	-.007	0.400	0.961	4.17
0.98	0.080	0.079	0.047	0.859	-.001	0.011	0.115	0.979	4.20
1.00	0.080	0.079	0.030	0.934	0.001	0.030	0.017	0.997	4.22
1.02	0.080	0.079	0.012	0.988	0.002	0.049	0.047	1.015	4.25
1.04	0.080	0.079	-.006	0.997	0.004	0.069	0.060	1.033	4.27
1.06	0.080	0.079	-.025	0.954	0.006	0.089	0.068	1.051	4.30
1.08	0.080	0.079	-.045	0.871	0.008	0.110	0.073	1.069	4.32
1.10	0.080	0.079	-.065	0.773	0.010	0.132	0.077	1.087	4.35

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.100	0.097	0.105	0.680	-.027	-.052	0.459	0.907	5.30
0.92	0.100	0.098	0.091	0.734	-.026	-.036	0.576	0.925	5.31
0.94	0.100	0.098	0.075	0.793	-.024	-.020	0.771	0.943	5.31
0.96	0.100	0.098	0.060	0.855	-.022	-.003	0.993	0.961	5.32
0.98	0.100	0.099	0.043	0.916	-.021	0.015	0.809	0.979	5.33
1.00	0.100	0.099	0.026	0.967	-.019	0.034	0.496	0.997	5.34
1.02	0.100	0.099	0.008	0.996	-.017	0.053	0.313	1.015	5.35
1.04	0.100	0.099	-.010	0.995	-.016	0.073	0.209	1.034	5.35
1.06	0.100	0.099	-.029	0.960	-.014	0.093	0.144	1.052	5.35
1.08	0.100	0.099	-.049	0.897	-.012	0.114	0.100	1.070	5.36
1.10	0.100	0.099	-.069	0.820	-.010	0.136	0.070	1.088	5.37

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.120	0.117	0.101	0.758	-.047	-.048	0.697	0.907	6.53
0.92	0.120	0.118	0.086	0.806	-.045	-.032	0.817	0.925	6.51
0.94	0.120	0.118	0.071	0.856	-.044	-.015	0.943	0.943	6.50
0.96	0.120	0.118	0.055	0.906	-.042	0.002	0.999	0.962	6.48
0.98	0.120	0.118	0.039	0.950	-.041	0.020	0.901	0.980	6.47
1.00	0.120	0.119	0.022	0.984	-.039	0.038	0.714	0.998	6.45
1.02	0.120	0.119	0.004	0.999	-.037	0.057	0.544	1.016	6.44
1.04	0.120	0.119	-.014	0.993	-.035	0.077	0.415	1.034	6.43
1.06	0.120	0.119	-.033	0.963	-.033	0.097	0.323	1.052	6.42
1.08	0.120	0.119	-.053	0.913	-.031	0.119	0.254	1.070	6.40
1.10	0.120	0.118	-.073	0.850	-.029	0.140	0.203	1.088	6.39

TABLE B-V, cont.

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
LIGHT LOAD CASE

ORIGINAL PAGE IS
OF POOR QUALITY

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.140	0.137	0.096	0.818	-.066	-.043	0.837	0.908	7.75
0.92	0.140	0.137	0.082	0.859	-.065	-.027	0.922	0.926	7.71
0.94	0.140	0.137	0.066	0.900	-.063	-.011	0.986	0.944	7.67
0.96	0.140	0.138	0.051	0.939	-.062	0.006	0.995	0.962	7.63
0.98	0.140	0.138	0.034	0.971	-.060	0.024	0.927	0.980	7.60
1.00	0.140	0.138	0.017	0.992	-.058	0.043	0.806	0.998	7.56
1.02	0.140	0.138	-.001	1.000	-.056	0.062	0.674	1.016	7.53
1.04	0.140	0.138	-.019	0.991	-.055	0.082	0.556	1.034	7.50
1.06	0.140	0.138	-.038	0.964	-.053	0.102	0.459	1.052	7.47
1.08	0.140	0.138	-.058	0.923	-.051	0.123	0.381	1.070	7.44
1.10	0.140	0.138	-.078	0.870	-.049	0.145	0.318	1.088	7.41

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.160	0.156	0.091	0.864	-.086	-.038	0.914	0.908	8.97
0.92	0.160	0.156	0.076	0.898	-.084	-.022	0.967	0.926	8.91
0.94	0.160	0.157	0.061	0.931	-.083	-.006	0.998	0.944	8.85
0.96	0.160	0.157	0.046	0.960	-.081	0.011	0.990	0.962	8.79
0.98	0.160	0.157	0.029	0.983	-.079	0.029	0.938	0.980	8.73
1.00	0.160	0.158	0.012	0.997	-.078	0.048	0.852	0.998	8.68
1.02	0.160	0.158	-.006	0.999	-.076	0.067	0.750	1.016	8.62
1.04	0.160	0.158	-.024	0.989	-.074	0.087	0.649	1.034	8.57
1.06	0.160	0.158	-.043	0.965	-.072	0.107	0.558	1.052	8.52
1.08	0.160	0.158	-.063	0.929	-.070	0.128	0.479	1.071	8.48
1.10	0.160	0.157	-.083	0.884	-.068	0.150	0.413	1.089	8.43

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.180	0.175	0.086	0.899	-.105	-.033	0.955	0.908	10.19
0.92	0.180	0.176	0.071	0.927	-.103	-.017	0.987	0.926	10.10
0.94	0.180	0.176	0.056	0.953	-.102	-.000	1.000	0.944	10.03
0.96	0.180	0.176	0.040	0.975	-.100	0.017	0.986	0.962	9.94
0.98	0.180	0.177	0.024	0.991	-.099	0.035	0.943	0.980	9.86
1.00	0.180	0.177	0.007	0.999	-.097	0.053	0.877	0.998	9.79
1.02	0.180	0.177	-.011	0.998	-.095	0.072	0.797	1.017	9.72
1.04	0.180	0.177	-.029	0.987	-.093	0.092	0.712	1.035	9.65
1.06	0.180	0.177	-.048	0.965	-.091	0.113	0.631	1.053	9.58
1.08	0.180	0.177	-.068	0.933	-.089	0.134	0.556	1.071	9.51
1.10	0.180	0.177	-.088	0.894	-.087	0.155	0.490	1.089	9.45

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.200	0.195	0.080	0.925	-.124	-.027	0.977	0.908	11.42
0.92	0.200	0.195	0.065	0.948	-.123	-.011	0.996	0.926	11.31
0.94	0.200	0.195	0.050	0.969	-.121	0.006	0.999	0.944	11.20
0.96	0.200	0.196	0.034	0.985	-.120	0.023	0.983	0.962	11.09
0.98	0.200	0.196	0.018	0.996	-.118	0.040	0.946	0.981	10.99
1.00	0.200	0.196	0.001	1.000	-.116	0.059	0.892	0.999	10.90
1.02	0.200	0.196	-.017	0.996	-.114	0.078	0.826	1.017	10.80
1.04	0.200	0.196	-.035	0.984	-.113	0.098	0.755	1.035	10.72
1.06	0.200	0.196	-.054	0.964	-.111	0.118	0.684	1.053	10.64
1.08	0.200	0.196	-.074	0.936	-.109	0.139	0.616	1.071	10.55
1.10	0.200	0.196	-.094	0.902	-.107	0.161	0.552	1.089	10.47

TABLE B-VI

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
HEAVY LOAD CASE

CONSTANT IMPEDANCE LOAD

ORIGINAL PAGE IS
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SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.020	0.016	0.164	0.099	0.550	0.261	0.904	0.841	-0.01
0.92	0.020	0.017	0.153	0.109	0.572	0.289	0.893	0.858	0.10
0.94	0.020	0.017	0.141	0.122	0.595	0.318	0.882	0.875	0.20
0.96	0.020	0.018	0.129	0.137	0.618	0.348	0.871	0.892	0.31
0.98	0.020	0.018	0.116	0.156	0.642	0.379	0.861	0.908	0.41
1.00	0.020	0.019	0.102	0.180	0.666	0.411	0.851	0.925	0.51
1.02	0.020	0.019	0.088	0.211	0.691	0.444	0.841	0.942	0.60
1.04	0.020	0.019	0.074	0.252	0.716	0.478	0.832	0.959	0.68
1.06	0.020	0.020	0.059	0.315	0.742	0.512	0.823	0.976	0.77
1.08	0.020	0.020	0.043	0.415	0.768	0.548	0.814	0.992	0.86
1.10	0.020	0.020	0.027	0.592	0.795	0.584	0.806	1.009	0.94

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.040	0.036	0.161	0.219	0.531	0.264	0.895	0.842	1.32
0.92	0.040	0.037	0.150	0.238	0.553	0.292	0.884	0.859	1.40
0.94	0.040	0.037	0.138	0.261	0.576	0.322	0.873	0.876	1.48
0.96	0.040	0.038	0.126	0.288	0.599	0.352	0.862	0.892	1.56
0.98	0.040	0.038	0.113	0.320	0.623	0.383	0.852	0.909	1.63
1.00	0.040	0.039	0.100	0.361	0.647	0.415	0.842	0.926	1.71
1.02	0.040	0.039	0.086	0.414	0.672	0.448	0.832	0.943	1.78
1.04	0.040	0.039	0.071	0.484	0.697	0.481	0.823	0.959	1.85
1.06	0.040	0.039	0.056	0.577	0.723	0.516	0.814	0.976	1.91
1.08	0.040	0.040	0.040	0.702	0.749	0.551	0.805	0.993	1.98
1.10	0.040	0.040	0.024	0.857	0.776	0.588	0.797	1.010	2.04

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.060	0.056	0.158	0.334	0.512	0.268	0.886	0.843	2.64
0.92	0.060	0.057	0.147	0.359	0.534	0.296	0.875	0.859	2.69
0.94	0.060	0.057	0.135	0.390	0.557	0.325	0.863	0.876	2.75
0.96	0.060	0.058	0.123	0.425	0.580	0.356	0.853	0.893	2.81
0.98	0.060	0.058	0.110	0.468	0.604	0.387	0.842	0.910	2.86
1.00	0.060	0.058	0.096	0.519	0.628	0.419	0.832	0.926	2.91
1.02	0.060	0.059	0.082	0.582	0.653	0.451	0.822	0.943	2.96
1.04	0.060	0.059	0.068	0.658	0.678	0.485	0.813	0.960	3.01
1.06	0.060	0.059	0.053	0.749	0.704	0.520	0.804	0.977	3.06
1.08	0.060	0.059	0.037	0.850	0.730	0.555	0.796	0.993	3.10
1.10	0.060	0.060	0.021	0.945	0.757	0.592	0.788	1.010	3.15

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.080	0.076	0.155	0.441	0.493	0.272	0.875	0.843	3.96
0.92	0.080	0.076	0.143	0.470	0.515	0.300	0.864	0.860	3.99
0.94	0.080	0.077	0.131	0.505	0.538	0.330	0.853	0.877	4.02
0.96	0.080	0.077	0.119	0.545	0.561	0.360	0.842	0.893	4.05
0.98	0.080	0.078	0.106	0.592	0.585	0.391	0.831	0.910	4.08
1.00	0.080	0.078	0.093	0.645	0.609	0.423	0.821	0.927	4.11
1.02	0.080	0.079	0.079	0.707	0.634	0.456	0.812	0.944	4.14
1.04	0.080	0.079	0.064	0.776	0.659	0.489	0.803	0.960	4.17
1.06	0.080	0.079	0.049	0.851	0.685	0.524	0.794	0.977	4.19
1.08	0.080	0.079	0.033	0.923	0.711	0.560	0.786	0.994	4.22
1.10	0.080	0.079	0.017	0.978	0.738	0.596	0.778	1.011	4.24

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.100	0.096	0.151	0.536	0.474	0.277	0.864	0.844	5.28
0.92	0.100	0.096	0.139	0.567	0.496	0.305	0.852	0.860	5.28
0.94	0.100	0.097	0.128	0.604	0.519	0.334	0.841	0.877	5.28
0.96	0.100	0.097	0.115	0.645	0.542	0.364	0.830	0.894	5.29
0.98	0.100	0.097	0.102	0.690	0.566	0.395	0.820	0.911	5.30
1.00	0.100	0.098	0.089	0.741	0.590	0.427	0.810	0.927	5.31
1.02	0.100	0.098	0.075	0.797	0.615	0.460	0.801	0.944	5.32
1.04	0.100	0.098	0.060	0.854	0.640	0.494	0.792	0.961	5.32
1.06	0.100	0.099	0.045	0.911	0.666	0.529	0.783	0.978	5.33
1.08	0.100	0.099	0.029	0.959	0.692	0.564	0.775	0.994	5.33
1.10	0.100	0.099	0.013	0.992	0.719	0.601	0.767	1.011	5.34

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.120	0.115	0.146	0.618	0.455	0.281	0.851	0.844	6.58
0.92	0.120	0.116	0.135	0.651	0.477	0.310	0.839	0.861	6.57
0.94	0.120	0.116	0.123	0.687	0.500	0.339	0.828	0.878	6.56
0.96	0.120	0.117	0.111	0.726	0.523	0.369	0.817	0.894	6.54
0.98	0.120	0.117	0.098	0.768	0.547	0.400	0.807	0.911	6.53
1.00	0.120	0.118	0.084	0.813	0.571	0.432	0.797	0.928	6.51
1.02	0.120	0.118	0.070	0.859	0.596	0.465	0.788	0.945	6.50
1.04	0.120	0.118	0.056	0.905	0.621	0.499	0.780	0.961	6.48
1.06	0.120	0.118	0.040	0.947	0.647	0.534	0.771	0.978	6.47
1.08	0.120	0.119	0.025	0.979	0.673	0.569	0.764	0.995	6.46
1.10	0.120	0.119	0.008	0.998	0.700	0.606	0.756	1.011	6.44

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.140	0.135	0.142	0.689	0.436	0.287	0.836	0.845	7.90
0.92	0.140	0.135	0.130	0.720	0.458	0.315	0.824	0.861	7.86
0.94	0.140	0.136	0.118	0.754	0.481	0.344	0.813	0.878	7.82
0.96	0.140	0.136	0.106	0.790	0.504	0.374	0.803	0.895	7.78
0.98	0.140	0.137	0.093	0.827	0.528	0.405	0.793	0.911	7.74
1.00	0.140	0.137	0.079	0.865	0.552	0.437	0.784	0.928	7.71
1.02	0.140	0.137	0.065	0.903	0.577	0.470	0.775	0.945	7.67
1.04	0.140	0.138	0.051	0.938	0.602	0.504	0.767	0.962	7.63
1.06	0.140	0.138	0.036	0.968	0.628	0.539	0.759	0.978	7.61
1.08	0.140	0.138	0.020	0.990	0.654	0.574	0.751	0.995	7.57
1.10	0.140	0.138	0.004	1.000	0.681	0.611	0.744	1.012	7.54

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.160	0.154	0.136	0.749	0.417	0.292	0.819	0.845	9.21
0.92	0.160	0.155	0.125	0.778	0.439	0.320	0.808	0.862	9.15
0.94	0.160	0.155	0.113	0.808	0.462	0.350	0.797	0.878	9.09
0.96	0.160	0.156	0.101	0.840	0.485	0.380	0.787	0.895	9.02
0.98	0.160	0.156	0.088	0.872	0.509	0.411	0.778	0.912	8.96
1.00	0.160	0.157	0.074	0.903	0.533	0.443	0.769	0.929	8.90
1.02	0.160	0.157	0.060	0.933	0.558	0.476	0.761	0.945	8.84
1.04	0.160	0.157	0.046	0.960	0.583	0.510	0.753	0.962	8.79
1.06	0.160	0.157	0.030	0.982	0.609	0.544	0.746	0.979	8.74
1.08	0.160	0.157	0.015	0.996	0.635	0.580	0.739	0.995	8.68
1.10	0.160	0.158	-.002	1.000	0.662	0.616	0.732	1.012	8.63

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TABLE B-VI, cont.

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.180	0.173	0.131	0.799	0.398	0.298	0.801	0.845	10.53
0.92	0.180	0.174	0.120	0.824	0.420	0.326	0.790	0.862	10.43
0.94	0.180	0.175	0.108	0.851	0.443	0.356	0.780	0.879	10.34
0.96	0.180	0.175	0.095	0.878	0.466	0.386	0.771	0.895	10.25
0.98	0.180	0.175	0.082	0.905	0.490	0.417	0.762	0.912	10.17
1.00	0.180	0.176	0.069	0.931	0.514	0.449	0.754	0.929	10.09
1.02	0.180	0.176	0.055	0.955	0.539	0.482	0.746	0.946	10.02
1.04	0.180	0.176	0.040	0.975	0.564	0.515	0.738	0.962	9.94
1.06	0.180	0.177	0.025	0.990	0.590	0.550	0.731	0.979	9.87
1.08	0.180	0.177	0.009	0.999	0.616	0.586	0.725	0.996	9.80
1.10	0.180	0.177	-.007	0.999	0.643	0.622	0.719	1.012	9.73

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.200	0.193	0.125	0.839	0.379	0.304	0.780	0.846	11.84
0.92	0.200	0.193	0.114	0.862	0.402	0.333	0.770	0.862	11.73
0.94	0.200	0.194	0.102	0.885	0.424	0.362	0.761	0.879	11.61
0.96	0.200	0.194	0.089	0.908	0.448	0.392	0.752	0.896	11.49
0.98	0.200	0.195	0.076	0.931	0.471	0.423	0.744	0.912	11.39
1.00	0.200	0.195	0.063	0.952	0.495	0.455	0.737	0.929	11.29
1.02	0.200	0.196	0.049	0.970	0.520	0.488	0.729	0.946	11.20
1.04	0.200	0.196	0.034	0.985	0.545	0.521	0.723	0.963	11.10
1.06	0.200	0.196	0.019	0.995	0.571	0.556	0.717	0.979	11.00
1.08	0.200	0.196	0.004	1.000	0.597	0.592	0.710	0.996	10.92
1.10	0.200	0.196	-.013	0.998	0.624	0.628	0.705	1.013	10.82

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.020	0.016	0.170	0.093	0.614	0.303	0.897	0.832	-0.07
0.92	0.020	0.016	0.158	0.103	0.631	0.327	0.888	0.850	0.04
0.94	0.020	0.017	0.146	0.116	0.648	0.353	0.878	0.868	0.16
0.96	0.020	0.018	0.133	0.131	0.665	0.379	0.869	0.885	0.27
0.98	0.020	0.018	0.120	0.150	0.683	0.406	0.860	0.903	0.38
1.00	0.020	0.019	0.106	0.173	0.700	0.433	0.850	0.921	0.48
1.02	0.020	0.019	0.091	0.203	0.718	0.461	0.841	0.939	0.58
1.04	0.020	0.019	0.076	0.246	0.736	0.490	0.832	0.956	0.67
1.06	0.020	0.020	0.060	0.309	0.754	0.520	0.823	0.974	0.77
1.08	0.020	0.020	0.044	0.413	0.772	0.550	0.814	0.992	0.86
1.10	0.020	0.020	0.026	0.601	0.790	0.581	0.806	1.010	0.94

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.040	0.036	0.167	0.210	0.595	0.306	0.889	0.833	1.27
0.92	0.040	0.036	0.156	0.228	0.612	0.331	0.880	0.851	1.35
0.94	0.040	0.037	0.143	0.250	0.629	0.356	0.870	0.868	1.44
0.96	0.040	0.038	0.131	0.277	0.646	0.382	0.861	0.886	1.53
0.98	0.040	0.038	0.117	0.309	0.663	0.409	0.851	0.904	1.61
1.00	0.040	0.039	0.103	0.350	0.681	0.437	0.842	0.922	1.69
1.02	0.040	0.039	0.088	0.403	0.699	0.465	0.833	0.939	1.77
1.04	0.040	0.039	0.073	0.473	0.716	0.494	0.823	0.957	1.84
1.06	0.040	0.039	0.057	0.569	0.734	0.523	0.814	0.975	1.91
1.08	0.040	0.040	0.041	0.699	0.753	0.554	0.806	0.993	1.98
1.10	0.040	0.040	0.023	0.862	0.771	0.585	0.797	1.010	2.05

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DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.060	0.056	0.164	0.322	0.576	0.310	0.881	0.834	2.61
0.92	0.060	0.056	0.152	0.347	0.593	0.334	0.871	0.851	2.66
0.94	0.060	0.057	0.140	0.376	0.610	0.360	0.861	0.869	2.73
0.96	0.060	0.057	0.127	0.412	0.627	0.386	0.852	0.887	2.79
0.98	0.060	0.058	0.114	0.454	0.644	0.413	0.842	0.904	2.84
1.00	0.060	0.058	0.100	0.505	0.662	0.440	0.833	0.922	2.90
1.02	0.060	0.059	0.085	0.569	0.679	0.468	0.823	0.940	2.95
1.04	0.060	0.059	0.070	0.646	0.697	0.497	0.814	0.958	3.00
1.06	0.060	0.059	0.054	0.741	0.715	0.527	0.805	0.975	3.05
1.08	0.060	0.059	0.037	0.848	0.733	0.557	0.796	0.993	3.10
1.10	0.060	0.060	0.020	0.948	0.752	0.589	0.787	1.011	3.15

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.080	0.076	0.160	0.426	0.557	0.314	0.871	0.834	3.94
0.92	0.080	0.076	0.149	0.455	0.573	0.338	0.861	0.852	3.97
0.94	0.080	0.077	0.137	0.490	0.590	0.364	0.851	0.870	4.01
0.96	0.080	0.077	0.124	0.530	0.608	0.390	0.842	0.887	4.04
0.98	0.080	0.078	0.110	0.576	0.625	0.417	0.832	0.905	4.07
1.00	0.080	0.078	0.096	0.631	0.642	0.444	0.822	0.923	4.11
1.02	0.080	0.079	0.081	0.694	0.660	0.473	0.813	0.940	4.14
1.04	0.080	0.079	0.066	0.767	0.678	0.502	0.804	0.958	4.17
1.06	0.080	0.079	0.050	0.845	0.696	0.531	0.795	0.976	4.19
1.08	0.080	0.079	0.033	0.921	0.714	0.562	0.786	0.994	4.22
1.10	0.080	0.079	0.016	0.980	0.733	0.593	0.777	1.011	4.24

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.100	0.095	0.156	0.520	0.537	0.318	0.861	0.835	5.27
0.92	0.100	0.096	0.145	0.552	0.554	0.343	0.851	0.852	5.27
0.94	0.100	0.096	0.133	0.588	0.571	0.368	0.841	0.870	5.28
0.96	0.100	0.097	0.120	0.629	0.588	0.394	0.831	0.888	5.29
0.98	0.100	0.097	0.106	0.676	0.606	0.421	0.821	0.906	5.30
1.00	0.100	0.098	0.092	0.728	0.623	0.449	0.812	0.923	5.31
1.02	0.100	0.098	0.077	0.786	0.641	0.477	0.802	0.941	5.31
1.04	0.100	0.098	0.062	0.846	0.659	0.506	0.793	0.959	5.32
1.06	0.100	0.099	0.046	0.906	0.677	0.536	0.784	0.976	5.33
1.08	0.100	0.099	0.029	0.959	0.695	0.566	0.775	0.994	5.33
1.10	0.100	0.099	0.012	0.993	0.713	0.597	0.767	1.012	5.34

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.120	0.115	0.152	0.602	0.518	0.323	0.849	0.835	6.59
0.92	0.120	0.116	0.140	0.635	0.535	0.348	0.839	0.853	6.58
0.94	0.120	0.116	0.128	0.671	0.552	0.373	0.829	0.871	6.57
0.96	0.120	0.117	0.115	0.711	0.569	0.399	0.819	0.888	6.55
0.98	0.120	0.117	0.102	0.755	0.587	0.426	0.809	0.906	6.53
1.00	0.120	0.118	0.088	0.802	0.604	0.454	0.800	0.924	6.52
1.02	0.120	0.118	0.073	0.851	0.622	0.482	0.790	0.941	6.50
1.04	0.120	0.118	0.058	0.899	0.640	0.511	0.781	0.959	6.48
1.06	0.120	0.118	0.042	0.944	0.658	0.540	0.773	0.977	6.47
1.08	0.120	0.119	0.025	0.979	0.676	0.571	0.764	0.994	6.46
1.10	0.120	0.119	0.008	0.998	0.694	0.602	0.755	1.012	6.44

TABLE B-VI, cont.

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR SYNCHRONOUS MACHINE, CONSTANT EXCITATION
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.140	0.134	0.147	0.674	0.499	0.328	0.836	0.836	7.92
0.92	0.140	0.135	0.136	0.705	0.516	0.353	0.826	0.853	7.88
0.94	0.140	0.136	0.123	0.740	0.533	0.378	0.816	0.871	7.84
0.96	0.140	0.136	0.110	0.777	0.550	0.404	0.806	0.889	7.80
0.98	0.140	0.137	0.097	0.815	0.567	0.431	0.796	0.906	7.76
1.00	0.140	0.137	0.083	0.856	0.585	0.459	0.787	0.924	7.72
1.02	0.140	0.137	0.068	0.896	0.603	0.487	0.778	0.942	7.68
1.04	0.140	0.138	0.053	0.934	0.620	0.516	0.769	0.959	7.64
1.06	0.140	0.138	0.037	0.966	0.638	0.545	0.760	0.977	7.60
1.08	0.140	0.138	0.020	0.990	0.657	0.576	0.752	0.995	7.57
1.10	0.140	0.138	0.003	1.000	0.675	0.607	0.744	1.013	7.54

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.160	0.154	0.142	0.734	0.480	0.333	0.822	0.836	9.24
0.92	0.160	0.154	0.130	0.764	0.497	0.358	0.811	0.854	9.18
0.94	0.160	0.155	0.118	0.795	0.514	0.384	0.801	0.871	9.11
0.96	0.160	0.156	0.105	0.828	0.531	0.410	0.792	0.889	9.04
0.98	0.160	0.156	0.092	0.862	0.548	0.436	0.782	0.907	8.98
1.00	0.160	0.156	0.078	0.896	0.566	0.464	0.773	0.924	8.91
1.02	0.160	0.157	0.063	0.928	0.584	0.492	0.764	0.942	8.85
1.04	0.160	0.157	0.048	0.957	0.601	0.521	0.756	0.960	8.80
1.06	0.160	0.157	0.032	0.980	0.619	0.551	0.747	0.977	8.74
1.08	0.160	0.157	0.015	0.995	0.637	0.581	0.739	0.995	8.69
1.10	0.160	0.158	-.002	1.000	0.656	0.612	0.731	1.013	8.63

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.180	0.173	0.136	0.785	0.461	0.339	0.805	0.837	10.58
0.92	0.180	0.174	0.125	0.812	0.478	0.364	0.796	0.854	10.48
0.94	0.180	0.174	0.113	0.840	0.495	0.389	0.786	0.872	10.39
0.96	0.180	0.175	0.100	0.869	0.512	0.415	0.777	0.889	10.29
0.98	0.180	0.175	0.086	0.897	0.529	0.442	0.767	0.907	10.20
1.00	0.180	0.176	0.072	0.925	0.547	0.470	0.759	0.925	10.11
1.02	0.180	0.176	0.057	0.951	0.564	0.498	0.750	0.942	10.03
1.04	0.180	0.176	0.042	0.973	0.582	0.5[illegible]	0.741	0.960	9.95
1.06	0.180	0.177	0.026	0.989	0.600	0.557	0.733	0.978	9.88
1.08	0.180	0.177	0.010	0.999	0.618	0.587	0.725	0.995	9.80
1.10	0.180	0.177	-.008	0.999	0.637	0.618	0.718	1.013	9.73

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	DELTA
0.90	0.200	0.192	0.130	0.828	0.442	0.346	0.788	0.837	11.91
0.92	0.200	0.193	0.119	0.851	0.459	0.370	0.779	0.854	11.78
0.94	0.200	0.194	0.107	0.876	0.476	0.396	0.769	0.872	11.66
0.96	0.200	0.194	0.094	0.900	0.493	0.422	0.760	0.890	11.55
0.98	0.200	0.195	0.080	0.924	0.510	0.448	0.751	0.907	11.42
1.00	0.200	0.195	0.066	0.947	0.528	0.476	0.743	0.925	11.32
1.02	0.200	0.195	0.052	0.967	0.546	0.504	0.735	0.943	11.21
1.04	0.200	0.196	0.036	0.983	0.563	0.533	0.726	0.960	11.11
1.06	0.200	0.196	0.020	0.995	0.581	0.563	0.719	0.978	11.01
1.08	0.200	0.196	0.004	1.000	0.600	0.593	0.711	0.996	10.91
1.10	0.200	0.196	-.013	0.998	0.618	0.624	0.704	1.013	10.82

TABLE B-VII

DATA FOR INDUCTION MACHINE
LIGHT LOAD CASE

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CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.015	-.019	0.628	-.026	0.048	0.067	0.584	0.890
0.92	0.020	0.015	-.020	0.608	-.025	0.051	0.070	0.591	0.910
0.94	0.020	0.015	-.021	0.588	-.024	0.054	0.073	0.598	0.930
0.96	0.020	0.015	-.022	0.568	-.023	0.057	0.076	0.604	0.950
0.98	0.020	0.015	-.022	0.548	-.022	0.061	0.079	0.610	0.969
1.00	0.020	0.014	-.023	0.528	-.021	0.064	0.082	0.615	0.989
1.02	0.020	0.014	-.024	0.508	-.021	0.067	0.085	0.620	1.009
1.04	0.020	0.014	-.025	0.488	-.020	0.071	0.088	0.624	1.029
1.06	0.020	0.014	-.026	0.469	-.019	0.074	0.092	0.628	1.048
1.08	0.020	0.014	-.027	0.450	-.018	0.078	0.095	0.632	1.068
1.10	0.020	0.013	-.028	0.431	-.018	0.081	0.099	0.636	1.088

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.035	-.022	0.847	-.053	0.028	0.070	0.375	0.891
0.92	0.040	0.035	-.023	0.839	-.051	0.031	0.073	0.395	0.911
0.94	0.040	0.035	-.023	0.830	-.048	0.034	0.075	0.414	0.930
0.96	0.040	0.035	-.024	0.821	-.046	0.038	0.078	0.432	0.950
0.98	0.040	0.035	-.025	0.811	-.045	0.041	0.081	0.448	0.970
1.00	0.040	0.034	-.026	0.801	-.043	0.044	0.084	0.463	0.990
1.02	0.040	0.034	-.026	0.790	-.041	0.047	0.088	0.476	1.009
1.04	0.040	0.034	-.027	0.779	-.040	0.051	0.091	0.489	1.029
1.06	0.040	0.034	-.028	0.768	-.038	0.054	0.094	0.501	1.049
1.08	0.040	0.033	-.029	0.756	-.037	0.058	0.097	0.511	1.069
1.10	0.040	0.033	-.030	0.744	-.035	0.062	0.101	0.521	1.089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.055	-.027	0.896	-.080	0.008	0.075	0.112	0.891
0.92	0.060	0.055	-.028	0.893	-.076	0.012	0.078	0.147	0.911
0.94	0.060	0.055	-.028	0.889	-.073	0.015	0.080	0.179	0.931
0.96	0.060	0.055	-.029	0.885	-.070	0.018	0.083	0.210	0.951
0.98	0.060	0.054	-.029	0.881	-.067	0.021	0.086	0.238	0.970
1.00	0.060	0.054	-.030	0.876	-.064	0.024	0.089	0.265	0.990
1.02	0.060	0.054	-.030	0.871	-.062	0.028	0.092	0.290	1.010
1.04	0.060	0.054	-.031	0.866	-.059	0.031	0.095	0.312	1.030
1.06	0.060	0.053	-.032	0.860	-.057	0.035	0.098	0.334	1.049
1.08	0.060	0.053	-.032	0.854	-.055	0.038	0.101	0.354	1.069
1.10	0.060	0.053	-.033	0.848	-.053	0.042	0.104	0.372	1.089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.075	-.035	0.906	-.108	-.011	0.082	0.134	0.891
0.92	0.080	0.075	-.035	0.906	-.103	-.008	0.085	0.096	0.911
0.94	0.080	0.074	-.035	0.905	-.099	-.005	0.087	0.058	0.931
0.96	0.080	0.074	-.035	0.904	-.094	-.002	0.089	0.021	0.951
0.98	0.080	0.074	-.035	0.902	-.090	0.001	0.092	0.014	0.971
1.00	0.080	0.074	-.036	0.900	-.087	0.005	0.095	0.049	0.990
1.02	0.080	0.074	-.036	0.898	-.083	0.008	0.097	0.082	1.010
1.04	0.080	0.073	-.036	0.896	-.080	0.011	0.100	0.113	1.030
1.06	0.080	0.073	-.037	0.893	-.077	0.015	0.103	0.143	1.050
1.08	0.080	0.073	-.037	0.890	-.074	0.018	0.106	0.172	1.069
1.10	0.080	0.073	-.038	0.887	-.071	0.022	0.109	0.199	1.089

DATA FOR INDUCTION MACHINE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.094	-.045	0.903	-.138	-.031	0.093	0.316	0.891
0.92	0.100	0.094	-.044	0.904	-.132	-.028	0.094	0.283	0.911
0.94	0.100	0.094	-.044	0.906	-.125	-.025	0.096	0.249	0.931
0.96	0.100	0.094	-.044	0.906	-.120	-.022	0.098	0.215	0.951
0.98	0.100	0.094	-.044	0.907	-.115	-.018	0.100	0.180	0.970
1.00	0.100	0.093	-.044	0.907	-.110	-.015	0.102	0.145	0.990
1.02	0.100	0.093	-.044	0.906	-.105	-.012	0.105	0.111	1.010
1.04	0.100	0.093	-.044	0.906	-.101	-.008	0.107	0.077	1.030
1.06	0.100	0.093	-.044	0.905	-.097	-.005	0.110	0.043	1.050
1.08	0.100	0.093	-.044	0.903	-.093	-.001	0.113	0.011	1.070
1.10	0.100	0.092	-.044	0.902	-.090	0.002	0.116	0.021	1 089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.114	-.058	0.891	-.172	-.050	0.106	0.430	0.890
0.92	0.120	0.114	-.057	0.894	-.163	-.047	0.107	0.406	0.910
0.94	0.120	0.113	-.056	0.898	-.154	-.044	0.108	0.380	0.930
0.96	0.120	0.113	-.055	0.900	-.147	-.041	0.109	0.353	0.950
0.98	0.120	0.113	-.054	0.902	-.140	-.038	0.111	0.324	0.970
1.00	0.120	0.113	-.053	0.904	-.134	-.035	0.112	0.295	0.990
1.02	0.120	0.113	-.053	0.905	-.128	-.031	0.114	0.264	1.010
1.04	0.120	0.113	-.053	0.906	-.123	-.028	0.116	0.233	1.030
1.06	0.120	0.113	-.052	0.906	-.118	-.024	0.119	0.201	1.050
1.08	0.120	0.112	-.052	0.907	-.113	-.021	0.121	0.170	1.070
1.10	0.120	0.112	-.052	0.906	-.109	-.017	0.123	0.138	1.089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.133	-.075	0.870	-.210	-.070	0.123	0.494	0.889
0.92	0.140	0.133	-.073	0.877	-.198	-.067	0.122	0.479	0.909
0.94	0.140	0.133	-.071	0.883	-.187	-.064	0.122	0.462	0.930
0.96	0.140	0.133	-.069	0.888	-.177	-.061	0.123	0.442	0.950
0.98	0.140	0.133	-.067	0.892	-.168	-.057	0.124	0.421	0.970
1.00	0.140	0.132	-.066	0.895	-.160	-.054	0.125	0.398	0.990
1.02	0.140	0.132	-.065	0.898	-.153	-.051	0.126	0.374	1.010
1.04	0.140	0.132	-.064	0.901	-.146	-.047	0.127	0.349	1.029
1.06	0.140	0.132	-.063	0.902	-.140	-.044	0.129	0.322	1.049
1.08	0.140	0.132	-.062	0.904	-.134	-.040	0.131	0.295	1.069
1.10	0.140	0.132	-.062	0.905	-.129	-.037	0.133	0.267	1.089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.152	-.098	0.840	-.257	-.089	0.146	0.521	0.887
0.92	0.160	0.152	-.094	0.852	-.239	-.086	0.143	0.515	0.908
0.94	0.160	0.152	-.090	0.861	-.224	-.083	0.141	0.507	0.928
0.96	0.160	0.152	-.086	0.869	-.211	-.080	0.140	0.495	0.949
0.98	0.160	0.152	-.084	0.876	-.199	-.077	0.140	0.481	0.969
1.00	0.160	0.152	-.081	0.882	-.189	-.074	0.140	0.466	0.989
1.02	0.160	0.152	-.079	0.887	-.180	-.070	0.140	0.448	1.009
1.04	0.160	0.152	-.077	0.891	-.171	-.067	0.141	0.429	1.029
1.06	0.160	0.151	-.076	0.894	-.163	-.063	0.142	0.408	1.049
1.08	0.160	0.151	-.075	0.897	-.156	-.060	0.143	0.386	1.069
1.10	0.160	0.151	-.074	0.899	-.150	-.056	0.145	0.363	1.089

TABLE B-VII, cont.

DATA FOR INDUCTION MACHINE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.180	0.170	-.133	0.789	-.326	-.108	0.180	0.515	0.884
0.92	0.180	0.171	-.123	0.812	-.295	-.105	0.172	0.522	0.906
0.94	0.180	0.171	-.115	0.829	-.271	-.102	0.167	0.523	0.926
0.96	0.180	0.171	-.109	0.843	-.252	-.099	0.163	0.520	0.947
0.98	0.180	0.171	-.104	0.854	-.236	-.096	0.160	0.514	0.967
1.00	0.180	0.171	-.100	0.863	-.222	-.093	0.159	0.505	0.988
1.02	0.180	0.171	-.097	0.870	-.210	-.090	0.158	0.494	1.008
1.04	0.180	0.171	-.094	0.876	-.199	-.086	0.157	0.481	1.028
1.06	0.180	0.171	-.091	0.882	-.189	-.083	0.157	0.466	1.048
1.08	0.180	0.171	-.089	0.886	-.181	-.079	0.158	0.450	1.063
1.10	0.180	0.171	-.087	0.890	-.172	-.076	0.156	0.432	1.088

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.92	0.200	0.188	-.175	0.732	-.400	-.124	0.224	0.483	0.900
0.94	0.200	0.189	-.153	0.777	-.342	-.121	0.205	0.509	0.923
0.96	0.200	0.190	-.141	0.803	-.308	-.118	0.194	0.520	0.944
0.98	0.200	0.190	-.132	0.821	-.283	-.115	0.188	0.523	0.965
1.00	0.200	0.190	-.125	0.836	-.263	-.112	0.183	0.522	0.986
1.02	0.200	0.190	-.119	0.847	-.246	-.109	0.180	0.518	1.006
1.04	0.200	0.190	-.114	0.857	-.231	-.106	0.178	0.511	1.027
1.06	0.200	0.190	-.110	0.865	-.219	-.102	0.176	0.502	1.047
1.08	0.200	0.190	-.107	0.872	-.207	-.099	0.175	0.491	1.067
1.10	0.200	0.190	-.104	0.877	-.197	-.095	0.175	0.479	1.087

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.015	-.019	0.629	-.026	0.053	0.071	0.602	0.890
0.92	0.020	0.015	-.020	0.609	-.025	0.055	0.073	0.605	0.910
0.94	0.020	0.015	-.021	0.589	-.024	0.058	0.075	0.609	0.929
0.96	0.020	0.015	-.022	0.568	-.023	0.060	0.078	0.611	0.949
0.98	0.020	0.015	-.022	0.548	-.022	0.062	0.080	0.614	0.969
1.00	0.020	0.014	-.023	0.528	-.021	0.064	0.082	0.616	0.989
1.02	0.020	0.014	-.024	0.509	-.021	0.067	0.085	0.619	1.009
1.04	0.020	0.014	-.025	0.488	-.020	0.069	0.087	0.621	1.029
1.06	0.020	0.014	-.026	0.468	-.019	0.071	0.090	0.622	1.049
1.08	0.020	0.013	-.027	0.449	-.018	0.074	0.092	0.624	1.069
1.10	0.020	0.013	-.028	0.430	-.018	0.076	0.095	0.626	1.089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.035	-.022	0.847	-.053	0.033	0.074	0.413	0.890
0.92	0.040	0.035	-.023	0.839	-.051	0.036	0.076	0.425	0.910
0.94	0.040	0.035	-.023	0.830	-.048	0.038	0.078	0.437	0.930
0.96	0.040	0.035	-.024	0.821	-.046	0.040	0.080	0.447	0.950
0.98	0.040	0.035	-.025	0.811	-.045	0.042	0.083	0.457	0.970
1.00	0.040	0.034	-.026	0.801	-.043	0.045	0.085	0.466	0.990
1.02	0.040	0.034	-.026	0.790	-.041	0.047	0.087	0.474	1.010
1.04	0.040	0.034	-.027	0.779	-.040	0.049	0.090	0.482	1.029
1.06	0.040	0.034	-.028	0.768	-.038	0.052	0.092	0.489	1.049
1.08	0.040	0.033	-.029	0.756	-.037	0.054	0.094	0.496	1.069
1.10	0.040	0.033	-.030	0.744	-.035	0.056	0.097	0.502	1.089

DATA FOR INDUCTION MACHINE
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.055	-.027	0.896	-.080	0.014	0.079	0.171	0.891
0.92	0.060	0.055	-.028	0.893	-.076	0.016	0.081	0.193	0.910
0.94	.060	0.055	-.028	0.889	-.073	0.018	0.083	0.214	0.930
0.96	.060	0.055	-.029	0.885	-.070	0.020	0.085	0.233	0.950
0.98	.060	0.054	-.029	0.881	-.067	0.023	0.087	0.252	0.970
1.00	0.060	0.054	-.030	0.876	-.064	0.025	0.089	0.269	0.990
1.02	0.060	0.054	-.030	0.871	-.062	0.027	0.091	0.285	1.010
1.04	0.060	0.054	-.031	0.866	-.059	0.029	0.093	0.301	1.030
1.06	0.060	0.053	-.032	0.860	-.057	0.032	0.096	0.315	1.050
1.08	0.060	0.053	-.032	0.854	-.055	0.034	0.098	0.329	1.070
1.10	0.060	0.053	-.033	0.848	-.053	0.036	0.100	0.342	1.090

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.075	-.035	0.906	-.108	-.006	0.086	0.068	0.891
0.92	0.080	0.075	-.035	0.906	-.103	-.004	0.088	0.043	0.911
0.94	0.080	0.074	-.035	0.905	-.099	-.002	0.090	0.017	0.930
0.96	0.080	0.074	-.035	0.904	-.094	0.001	0.091	0.007	0.950
0.98	0.080	0.074	-.035	0.902	-.090	0.003	0.093	0.031	0.970
1.00	0.080	0.074	-.036	0.900	-.087	0.005	0.095	0.054	0.990
1.02	0.080	0.074	-.036	0.898	-.083	0.007	0.097	0.076	1.010
1.04	0.080	0.073	-.036	0.896	-.080	0.010	0.099	0.098	1.030
1.06	0.080	0.073	-.037	0.893	-.077	0.012	0.101	0.118	1.050
1.08	0.080	0.073	-.037	0.890	-.074	0.014	0.103	0.138	1.070
1.10	0.080	0.073	-.038	0.886	-.071	0.017	0.105	0.157	1.090

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.094	-.045	0.903	-.139	-.026	0.097	0.256	0.890
0.92	0.100	0.094	-.044	0.904	-.132	-.023	0.098	0.233	0.910
0.94	0.100	0.094	-.044	0.906	-.126	-.021	0.099	0.210	0.930
0.96	0.100	0.094	-.044	0.906	-.120	-.019	0.100	0.186	0.950
0.98	0.100	0.094	-.044	0.907	-.115	-.017	0.101	0.163	0.970
1.00	0.100	0.093	-.044	0.907	-.110	-.014	0.103	0.140	0.990
1.02	0.100	0.093	-.044	0.906	-.105	-.012	0.104	0.116	1.010
1.04	0.100	0.093	-.044	0.906	-.101	-.010	0.106	0.094	1.030
1.06	0.100	0.093	-.044	0.905	-.097	-.008	0.108	0.071	1.050
1.08	0.100	0.093	-.044	0.903	-.093	-.005	0.110	0.049	1.070
1.10	0.100	0.092	-.044	0.902	-.089	-.003	0.111	0.027	1.090

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.114	-.058	0.890	-.172	-.045	0.110	0.379	0.890
0.92	0.120	0.114	-.057	0.894	-.163	-.043	0.110	0.363	0.910
0.94	0.120	0.113	-.056	0.898	-.155	-.041	0.110	0.346	0.930
0.96	0.120	0.113	-.055	0.900	-.147	-.039	0.111	0.328	0.950
0.98	0.120	0.113	-.054	0.902	-.140	-.036	0.112	0.307	0.970
1.00	0.120	0.113	-.053	0.904	-.134	-.034	0.113	0.289	0.990
1.02	0.120	0.113	-.053	0.905	-.128	-.032	0.114	0.269	1.010
1.04	0.120	0.113	-.053	0.906	-.123	-.030	0.115	0.249	1.030
1.06	0.120	0.113	-.052	0.906	-.118	-.027	0.116	0.228	1.050
1.08	0.120	0.112	-.052	0.907	-.113	-.025	0.118	0.207	1.070
1.10	0.120	0.112	-.052	0.906	-.109	-.023	0.119	0.187	1.090

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DATA FOR INDUCTION MACHINE
LIGHT LOAD CASE

ORIGINAL PAGE IS
OF POOR QUALITY

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.133	-.075	0.870	-.210	-.064	0.127	0.452	0.889
0.92	0.140	0.133	-.073	0.877	-.198	-.062	0.126	0.443	0.909
0.94	0.140	0.133	-.071	0.883	-.187	-.060	0.125	0.433	0.929
0.96	0.140	0.133	-.069	0.888	-.177	-.058	0.125	0.421	0.949
0.98	0.140	0.133	-.067	0.892	-.168	-.056	0.125	0.408	0.969
1.00	0.140	0.132	-.066	0.895	-.160	-.054	0.125	0.394	0.990
1.02	0.140	0.132	-.065	0.898	-.153	-.051	0.126	0.379	1.010
1.04	0.140	0.132	-.064	0.901	-.146	-.049	0.126	0.363	1.030
1.06	0.140	0.132	-.063	0.902	-.140	-.047	0.127	0.346	1.050
1.08	0.140	0.132	-.062	0.904	-.134	-.045	0.128	0.329	1.070
1.10	0.140	0.132	-.062	0.905	-.128	-.042	0.129	0.311	1.090

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.152	-.099	0.839	-.258	-.083	0.150	0.487	0.887
0.92	0.160	0.152	-.094	0.851	-.240	-.081	0.147	0.486	0.907
0.94	0.160	0.152	-.090	0.861	-.225	-.079	0.144	0.482	0.928
0.96	0.160	0.152	-.086	0.869	-.211	-.077	0.142	0.477	0.948
0.98	0.160	0.152	-.084	0.876	-.200	-.075	0.141	0.470	0.969
1.00	0.160	0.152	-.081	0.882	-.189	-.073	0.140	0.461	0.989
1.02	0.160	0.152	-.079	0.887	-.180	-.071	0.140	0.452	1.009
1.04	0.160	0.152	-.077	0.891	-.171	-.069	0.140	0.441	1.029
1.06	0.160	0.151	-.076	0.894	-.163	-.066	0.140	0.429	1.049
1.08	0.160	0.151	-.075	0.897	-.156	-.064	0.140	0.416	1.069
1.10	0.160	0.151	-.073	0.899	-.150	-.062	0.141	0.402	1.089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.180	0.170	-.133	0.788	-.327	-.102	0.184	0.486	0.884
0.92	0.180	0.171	-.123	0.812	-.296	-.100	0.175	0.497	0.905
0.94	0.180	0.171	-.115	0.829	-.272	-.098	0.169	0.502	0.926
0.96	0.180	0.171	-.109	0.843	-.253	-.096	0.165	0.504	0.947
0.98	0.180	0.171	-.104	0.854	-.236	-.094	0.162	0.504	0.967
1.00	0.180	0.171	-.100	0.863	-.222	-.092	0.159	0.501	0.988
1.02	0.180	0.171	-.097	0.870	-.210	-.090	0.157	0.497	1.008
1.04	0.180	0.171	-.094	0.876	-.199	-.088	0.156	0.491	1.028
1.06	0.180	0.171	-.091	0.882	-.189	-.086	0.155	0.483	1.048
1.08	0.180	0.171	-.089	0.886	-.180	-.083	0.155	0.475	1.069
1.10	0.180	0.171	-.087	0.890	-.172	-.081	0.154	0.466	1.089

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.92	0.200	0.188	-.176	0.730	-.402	-.119	0.229	0.461	0.900
0.94	0.200	0.189	-.154	0.776	-.343	-.117	0.208	0.491	0.922
0.96	0.200	0.190	-.141	0.802	-.309	-.115	0.197	0.506	0.944
0.98	0.200	0.190	-.132	0.821	-.283	-.113	0.189	0.514	0.965
1.00	0.200	0.190	-.125	0.836	-.263	-.111	0.184	0.518	0.986
1.02	0.200	0.190	-.119	0.847	-.246	-.109	0.180	0.520	1.006
1.04	0.200	0.190	-.114	0.857	-.231	-.107	0.176	0.519	1.027
1.06	0.200	0.190	-.110	0.865	-.219	-.105	0.174	0.517	1.047
1.08	0.200	0.190	-.107	0.872	-.207	-.103	0.172	0.513	1.068
1.10	0.200	0.190	-.104	0.877	-.197	-.101	0.171	0.508	1.088

TABLE B-VIII

DATA FOR INDUCTION MACHINE
HEAVY LOAD CASE

ORIGINAL PAGE IS
OF POOR QUALITY

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.016	-.017	0.696	-.031	0.525	0.422	0.779	0.822
0.92	0.020	0.016	-.017	0.678	-.030	0.549	0.441	0.780	0.840
0.94	0.020	0.016	-.018	0.660	-.028	0.574	0.460	0.780	0.859
0.96	0.020	0.016	-.019	0.642	-.027	0.599	0.480	0.781	0.877
0.98	0.020	0.015	-.019	0.624	-.026	0.626	0.500	0.781	0.895
1.00	0.020	0.015	-.020	0.605	-.025	0.652	0.521	0.782	0.913
1.02	0.020	0.015	-.021	0.586	-.024	0.679	0.541	0.782	0.932
1.04	0.020	0.015	-.022	0.568	-.023	0.707	0.563	0.782	0.950
1.06	0.020	0.015	-.022	0.549	-.022	0.735	0.585	0.783	0.968
1.08	0.020	0.014	-.023	0.531	-.022	0.764	0.607	0.783	0.986
1.10	0.020	0.014	-.024	0.512	-.021	0.793	0.629	0.783	1.005

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.036	-.020	0.872	-.062	0.506	0.426	0.764	0.823
0.92	0.040	0.036	-.021	0.866	-.059	0.530	0.445	0.766	0.841
0.94	0.040	0.036	-.021	0.859	-.057	0.555	0.464	0.767	0.859
0.96	0.040	0.035	-.022	0.852	-.055	0.580	0.484	0.768	0.877
0.98	0.040	0.035	-.022	0.845	-.052	0.607	0.504	0.769	0.896
1.00	0.040	0.035	-.023	0.837	-.050	0.633	0.524	0.770	0.914
1.02	0.040	0.035	-.024	0.829	-.048	0.660	0.545	0.771	0.932
1.04	0.040	0.035	-.024	0.821	-.046	0.688	0.566	0.772	0.950
1.06	0.040	0.035	-.025	0.812	-.045	0.716	0.588	0.773	0.969
1.08	0.040	0.034	-.026	0.803	-.043	0.745	0.610	0.774	0.987
1.10	0.040	0.034	-.026	0.793	-.041	0.774	0.632	0.774	1.005

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.056	-.026	0.904	-.094	0.486	0.433	0.747	0.823
0.92	0.060	0.056	-.027	0.902	-.090	0.511	0.451	0.749	0.841
0.94	0.060	0.055	-.027	0.900	-.086	0.536	0.470	0.752	0.860
0.96	0.060	0.055	-.027	0.898	-.082	0.561	0.489	0.754	0.878
0.98	0.060	0.055	-.027	0.895	-.079	0.587	0.509	0.756	0.896
1.00	0.060	0.055	-.028	0.892	-.076	0.614	0.529	0.757	0.914
1.02	0.060	0.055	-.028	0.889	-.073	0.641	0.550	0.759	0.933
1.04	0.060	0.055	-.029	0.885	-.070	0.669	0.571	0.760	0.951
1.06	0.060	0.054	-.029	0.881	-.067	0.697	0.593	0.762	0.969
1.08	0.060	0.054	-.030	0.877	-.065	0.726	0.615	0.763	0.987
1.10	0.060	0.054	-.030	0.872	-.062	0.755	0.637	0.764	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.075	-.035	0.905	-.129	0.467	0.442	0.726	0.823
0.92	0.080	0.075	-.035	0.906	-.123	0.491	0.460	0.730	0.841
0.94	0.080	0.075	-.035	0.906	-.117	0.516	0.478	0.734	0.860
0.96	0.080	0.075	-.035	0.907	-.112	0.542	0.497	0.737	0.878
0.98	0.080	0.075	-.035	0.906	-.107	0.568	0.517	0.740	0.896
1.00	0.080	0.075	-.035	0.906	-.102	0.595	0.537	0.742	0.915
1.02	0.080	0.074	-.035	0.905	-.098	0.622	0.557	0.745	0.933
1.04	0.080	0.074	-.035	0.904	-.094	0.649	0.578	0.747	0.951
1.06	0.080	0.074	-.035	0.902	-.091	0.678	0.599	0.749	0.969
1.08	0.080	0.074	-.036	0.901	-.087	0.706	0.621	0.751	0.988
1.10	0.080	0.074	-.036	0.899	-.084	0.736	0.643	0.753	1.006

TABLE B-VIII, cont.

DATA FOR INDUCTION MACHINE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.095	-.048	0.893	-.167	0.447	0.454	0.701	0.823
0.92	0.100	0.095	-.047	0.896	-.158	0.471	0.471	0.707	0.841
0.94	0.100	0.094	-.046	0.899	-.150	0.496	0.489	0.712	0.859
0.96	0.100	0.094	-.045	0.901	-.143	0.522	0.508	0.717	0.878
0.98	0.100	0.094	-.045	0.903	-.137	0.548	0.527	0.721	0.896
1.00	0.100	0.094	-.044	0.905	-.130	0.575	0.546	0.725	0.914
1.02	0.100	0.094	-.044	0.906	-.125	0.602	0.566	0.729	0.933
1.04	0.100	0.094	-.044	0.906	-.120	0.630	0.586	0.732	0.951
1.06	0.100	0.094	-.044	0.907	-.115	0.658	0.607	0.735	0.969
1.08	0.100	0.094	-.044	0.907	-.110	0.687	0.629	0.738	0.988
1.10	0.100	0.093	-.044	0.906	-.106	0.716	0.651	0.740	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.114	-.065	0.869	-.211	0.426	0.470	0.672	0.822
0.92	0.120	0.114	-.063	0.877	-.199	0.451	0.486	0.680	0.840
0.94	0.120	0.114	-.061	0.883	-.188	0.476	0.503	0.687	0.859
0.96	0.120	0.114	-.059	0.887	-.178	0.502	0.521	0.694	0.877
0.98	0.120	0.114	-.058	0.892	-.169	0.528	0.539	0.700	0.896
1.00	0.120	0.114	-.057	0.895	-.161	0.555	0.558	0.705	0.914
1.02	0.120	0.113	-.056	0.898	-.154	0.582	0.577	0.710	0.932
1.04	0.120	0.113	-.055	0.900	-.147	0.610	0.597	0.715	0.951
1.06	0.120	0.113	-.054	0.902	-.141	0.638	0.618	0.719	0.969
1.08	0.120	0.113	-.054	0.904	-.135	0.667	0.639	0.722	0.988
1.10	0.120	0.113	-.053	0.905	-.129	0.697	0.660	0.726	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.133	-.089	0.832	-.268	0.405	0.492	0.635	0.820
0.92	0.140	0.133	-.084	0.845	-.249	0.430	0.506	0.647	0.839
0.94	0.140	0.133	-.080	0.856	-.233	0.455	0.522	0.658	0.858
0.96	0.140	0.133	-.077	0.865	-.219	0.481	0.538	0.667	0.876
0.98	0.140	0.133	-.075	0.872	-.206	0.508	0.555	0.675	0.895
1.00	0.140	0.133	-.072	0.878	-.195	0.535	0.573	0.682	0.913
1.02	0.140	0.133	-.070	0.884	-.186	0.562	0.591	0.689	0.932
1.04	0.140	0.133	-.069	0.888	-.177	0.590	0.611	0.695	0.950
1.06	0.140	0.133	-.067	0.892	-.169	0.618	0.630	0.700	0.969
1.08	0.140	0.133	-.066	0.895	-.161	0.647	0.651	0.705	0.987
1.10	0.140	0.132	-.065	0.898	-.154	0.677	0.672	0.710	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.151	-.129	0.760	-.364	0.382	0.529	0.585	0.816
0.92	0.160	0.152	-.117	0.792	-.322	0.408	0.536	0.605	0.836
0.94	0.160	0.152	-.108	0.814	-.293	0.434	0.547	0.621	0.855
0.96	0.160	0.152	-.102	0.830	-.270	0.460	0.561	0.634	0.874
0.98	0.160	0.152	-.097	0.843	-.252	0.487	0.576	0.645	0.893
1.00	0.160	0.152	-.093	0.854	-.236	0.514	0.592	0.655	0.912
1.02	0.160	0.152	-.089	0.862	-.223	0.541	0.609	0.664	0.931
1.04	0.160	0.152	-.086	0.870	-.211	0.569	0.627	0.672	0.949
1.06	0.160	0.152	-.084	0.876	-.200	0.598	0.646	0.679	0.968
1.08	0.160	0.152	-.081	0.881	-.190	0.627	0.665	0.686	0.987
1.10	0.160	0.152	-.080	0.886	-.181	0.656	0.686	0.692	1.005

ORIGINAL PAGE IS
OF POOR QUALITY

DATA FOR INDUCTION MACHINE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.94	0.180	0.169	-.163	0.720	-.416	0.409	0.597	0.565	0.850
0.96	0.180	0.170	-.141	0.770	-.351	0.437	0.597	0.591	0.871
0.98	0.180	0.171	-.129	0.797	-.315	0.464	0.605	0.609	0.891
1.00	0.180	0.171	-.121	0.817	-.289	0.492	0.618	0.623	0.910
1.02	0.180	0.171	-.114	0.832	-.269	0.520	0.632	0.635	0.929
1.04	0.180	0.171	-.109	0.844	-.251	0.548	0.648	0.646	0.948
1.06	0.180	0.171	-.104	0.853	-.237	0.577	0.665	0.655	0.967
1.08	0.180	0.171	-.101	0.862	-.224	0.606	0.683	0.663	0.986
1.10	0.180	0.171	-.097	0.869	-.212	0.636	0.702	0.671	1.004

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
1.00	0.200	0.189	-.168	0.747	-.381	0.468	0.661	0.578	0.906
1.02	0.200	0.189	-.151	0.782	-.336	0.497	0.666	0.598	0.926
1.04	0.200	0.190	-.140	0.804	-.306	0.526	0.677	0.614	0.946
1.06	0.200	0.190	-.132	0.821	-.283	0.555	0.691	0.627	0.965
1.08	0.200	0.190	-.125	0.835	-.264	0.585	0.706	0.638	0.984
1.10	0.200	0.190	-.120	0.845	-.249	0.615	0.723	0.647	1.003

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.016	-.016	0.706	-.032	0.593	0.473	0.782	0.811
0.92	0.020	0.016	-.017	0.688	-.030	0.612	0.488	0.782	0.830
0.94	0.020	0.016	-.018	0.669	-.029	0.632	0.503	0.782	0.850
0.96	0.020	0.016	-.018	0.650	-.028	0.651	0.518	0.782	0.869
0.98	0.020	0.015	-.019	0.630	-.027	0.670	0.534	0.782	0.888
1.00	0.020	0.015	-.020	0.611	-.025	0.690	0.549	0.783	0.908
1.02	0.020	0.015	-.021	0.591	-.024	0.710	0.564	0.783	0.927
1.04	0.020	0.015	-.021	0.571	-.023	0.730	0.580	0.783	0.947
1.06	0.020	0.015	-.022	0.551	-.022	0.750	0.596	0.783	0.966
1.08	0.020	0.014	-.023	0.531	-.022	0.770	0.612	0.783	0.985
1.10	0.020	0.014	-.024	0.512	-.021	0.791	0.628	0.783	1.005

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.036	-.020	0.875	-.064	0.574	0.477	0.769	0.812
0.92	0.040	0.036	-.020	0.869	-.061	0.593	0.492	0.770	0.831
0.94	0.040	0.036	-.021	0.862	-.058	0.612	0.507	0.770	0.850
0.96	0.040	0.036	-.022	0.855	-.056	0.632	0.522	0.771	0.870
0.98	0.040	0.035	-.022	0.848	-.053	0.651	0.537	0.772	0.889
1.00	0.040	0.035	-.023	0.840	-.051	0.671	0.552	0.772	0.908
1.02	0.040	0.035	-.023	0.831	-.049	0.691	0.568	0.773	0.928
1.04	0.040	0.035	-.024	0.822	-.047	0.711	0.583	0.773	0.947
1.06	0.040	0.035	-.025	0.813	-.045	0.731	0.599	0.774	0.967
1.08	0.040	0.034	-.025	0.803	-.043	0.751	0.615	0.774	0.986
1.10	0.040	0.034	-.026	0.793	-.041	0.772	0.630	0.774	1.005

TABLE B-VIII, cont.

DATA FOR INDUCTION MACHINE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.056	-.026	0.905	-.097	0.555	0.484	0.753	0.812
0.92	0.060	0.056	-.026	0.903	-.092	0.574	0.498	0.755	0.831
0.94	0.060	0.055	-.027	0.901	-.088	0.593	0.513	0.756	0.851
0.96	0.060	0.055	-.027	0.899	-.084	0.612	0.528	0.758	0.870
0.98	0.060	0.055	-.027	0.896	-.080	0.632	0.543	0.759	0.889
1.00	0.060	0.055	-.028	0.893	-.077	0.652	0.558	0.760	0.909
1.02	0.060	0.055	-.028	0.889	-.073	0.671	0.573	0.761	0.928
1.04	0.060	0.055	-.029	0.886	-.070	0.691	0.588	0.762	0.948
1.06	0.060	0.054	-.029	0.882	-.068	0.712	0.604	0.763	0.967
1.08	0.060	0.054	-.030	0.877	-.065	0.732	0.619	0.763	0.986
1.10	0.060	0.054	-.030	0.872	-.062	0.752	0.635	0.764	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.075	-.036	0.904	-.133	0.535	0.493	0.735	0.812
0.92	0.080	0.075	-.035	0.906	-.126	0.554	0.507	0.738	0.831
0.94	0.080	0.075	-.035	0.906	-.120	0.573	0.521	0.740	0.851
0.96	0.080	0.075	-.035	0.907	-.114	0.593	0.536	0.742	0.870
0.98	0.080	0.075	-.035	0.906	-.109	0.612	0.550	0.744	0.890
1.00	0.080	0.075	-.035	0.906	-.104	0.632	0.565	0.746	0.909
1.02	0.080	0.074	-.035	0.905	-.099	0.652	0.580	0.747	0.928
1.04	0.080	0.074	-.035	0.904	-.095	0.672	0.595	0.749	0.948
1.06	0.080	0.074	-.035	0.902	-.091	0.692	0.610	0.750	0.967
1.08	0.080	0.074	-.036	0.901	-.087	0.712	0.625	0.752	0.987
1.10	0.080	0.074	-.036	0.899	-.084	0.733	0.641	0.753	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.095	-.048	0.890	-.172	0.515	0.506	0.713	0.811
0.92	0.100	0.095	-.047	0.894	-.163	0.534	0.519	0.717	0.831
0.94	0.100	0.095	-.046	0.898	-.154	0.554	0.532	0.721	0.851
0.96	0.100	0.094	-.046	0.901	-.146	0.573	0.546	0.724	0.870
0.98	0.100	0.094	-.045	0.903	-.139	0.593	0.560	0.727	0.890
1.00	0.100	0.094	-.044	0.904	-.132	0.613	0.574	0.729	0.909
1.02	0.100	0.094	-.044	0.905	-.126	0.632	0.589	0.732	0.928
1.04	0.100	0.094	-.044	0.906	-.121	0.652	0.604	0.734	0.948
1.06	0.100	0.094	-.044	0.907	-.115	0.673	0.618	0.736	0.967
1.08	0.100	0.094	-.044	0.907	-.110	0.693	0.633	0.738	0.987
1.10	0.100	0.093	-.044	0.906	-.106	0.713	0.648	0.740	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.114	-.066	0.865	-.219	0.495	0.523	0.687	0.810
0.92	0.120	0.114	-.064	0.873	-.205	0.514	0.535	0.693	0.830
0.94	0.120	0.114	-.062	0.880	-.193	0.534	0.547	0.698	0.850
0.96	0.120	0.114	-.060	0.886	-.182	0.553	0.560	0.703	0.869
0.98	0.120	0.114	-.058	0.890	-.172	0.573	0.573	0.707	0.889
1.00	0.120	0.114	-.057	0.894	-.163	0.593	0.587	0.711	0.909
1.02	0.120	0.113	-.056	0.897	-.155	0.613	0.600	0.714	0.928
1.04	0.120	0.113	-.055	0.900	-.148	0.633	0.614	0.717	0.948
1.06	0.120	0.113	-.054	0.902	-.141	0.653	0.629	0.720	0.967
1.08	0.120	0.113	-.054	0.904	-.135	0.673	0.643	0.723	0.987
1.10	0.120	0.113	-.053	0.905	-.129	0.694	0.658	0.725	1.006

TABLE B-VIII, cont.

DATA FOR INDUCTION MACHINE
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.133	-.092	0.822	-.282	0.474	0.547	0.655	0.808
0.92	0.140	0.133	-.086	0.838	-.259	0.493	0.556	0.664	0.828
0.94	0.140	0.133	-.082	0.851	-.240	0.513	0.567	0.671	0.848
0.96	0.140	0.133	-.078	0.861	-.224	0.533	0.578	0.678	0.868
0.98	0.140	0.133	-.075	0.870	-.211	0.553	0.590	0.684	0.888
1.00	0.140	0.133	-.073	0.877	-.199	0.573	0.602	0.689	0.908
1.02	0.140	0.133	-.071	0.883	-.188	0.593	0.615	0.694	0.928
1.04	0.140	0.133	-.069	0.887	-.178	0.613	0.628	0.698	0.947
1.06	0.140	0.133	-.067	0.891	-.169	0.633	0.642	0.702	0.967
1.08	0.140	0.133	-.066	0.895	-.161	0.653	0.655	0.706	0.986
1.10	0.140	0.132	-.065	0.898	-.154	0.674	0.670	0.709	1.006

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.151	-.143	0.725	-.409	0.451	0.594	0.605	0.803
0.92	0.160	0.151	-.123	0.776	-.343	0.472	0.590	0.624	0.825
0.94	0.160	0.152	-.112	0.804	-.306	0.492	0.595	0.637	0.846
0.96	0.160	0.152	-.104	0.824	-.279	0.512	0.602	0.648	0.866
0.98	0.160	0.152	-.099	0.839	-.258	0.532	0.612	0.656	0.887
1.00	0.160	0.152	-.094	0.851	-.241	0.552	0.622	0.664	0.907
1.02	0.160	0.152	-.090	0.861	-.226	0.572	0.633	0.671	0.926
1.04	0.160	0.152	-.087	0.869	-.213	0.593	0.645	0.676	0.946
1.06	0.160	0.152	-.084	0.875	-.201	0.613	0.658	0.682	0.966
1.08	0.160	0.152	-.082	0.881	-.191	0.633	0.670	0.687	0.986
1.10	0.160	0.152	-.079	0.886	-.181	0.654	0.684	0.691	1.005

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.96	0.180	0.170	-.149	0.753	-.373	0.490	0.644	0.606	0.862
0.98	0.180	0.170	-.133	0.788	-.327	0.511	0.644	0.621	0.884
1.00	0.180	0.171	-.123	0.811	-.296	0.531	0.649	0.633	0.904
1.02	0.180	0.171	-.116	0.828	-.273	0.552	0.657	0.643	0.925
1.04	0.180	0.171	-.110	0.842	-.254	0.572	0.667	0.651	0.945
1.06	0.180	0.171	-.105	0.852	-.238	0.593	0.678	0.658	0.965
1.08	0.180	0.171	-.101	0.861	-.224	0.613	0.689	0.665	0.985
1.10	0.180	0.171	-.097	0.869	-.212	0.634	0.701	0.671	1.004

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
1.00	0.200	0.188	-.177	0.729	-.403	0.509	0.699	0.588	0.899
1.02	0.200	0.189	-.155	0.774	-.345	0.530	0.694	0.607	0.921
1.04	0.200	0.190	-.142	0.801	-.311	0.551	0.697	0.620	0.942
1.06	0.200	0.190	-.133	0.819	-.285	0.572	0.704	0.630	0.963
1.08	0.200	0.190	-.126	0.834	-.265	0.593	0.712	0.639	0.983
1.10	0.200	0.190	-.120	0.846	-.248	0.613	0.722	0.647	1.003

TABLE B-IX

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
LIGHT LOAD CASE

CONSTANT IMPEDANCE LOAD

ORIGINAL PAGE IS OF POOR QUALITY

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.013	0.078	0.168	-.023	0.052	-.030	0.866	0.901
0.92	0.020	0.013	0.082	0.158	-.022	0.055	-.031	0.869	0.921
0.94	0.020	0.013	0.086	0.148	-.021	0.058	-.033	0.872	0.941
0.96	0.020	0.013	0.089	0.139	-.020	0.061	-.034	0.874	0.961
0.98	0.020	0.012	0.093	0.130	-.019	0.065	-.036	0.877	0.981
1.00	0.020	0.012	0.097	0.122	-.018	0.068	-.037	0.879	1.001
1.02	0.020	0.012	0.101	0.114	-.018	0.072	-.039	0.881	1.021
1.04	0.020	0.011	0.105	0.107	-.017	0.075	-.040	0.882	1.041
1.06	0.020	0.011	0.109	0.099	-.016	0.079	-.042	0.884	1.061
1.08	0.020	0.011	0.114	0.093	-.015	0.083	-.043	0.886	1.081
1.10	0.020	0.010	0.118	0.087	-.015	0.087	-.045	0.887	1.101

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.033	0.076	0.402	-.049	0.032	-.027	0.760	0.902
0.92	0.040	0.033	0.080	0.383	-.047	0.035	-.029	0.774	0.922
0.94	0.040	0.033	0.083	0.365	-.045	0.038	-.030	0.785	0.942
0.96	0.040	0.032	0.087	0.348	-.043	0.042	-.032	0.794	0.962
0.98	0.040	0.032	0.091	0.332	-.041	0.045	-.033	0.803	0.982
1.00	0.040	0.032	0.095	0.317	-.039	0.048	-.035	0.811	1.002
1.02	0.040	0.032	0.099	0.303	-.038	0.052	-.037	0.817	1.022
1.04	0.040	0.031	0.103	0.289	-.036	0.056	-.038	0.823	1.042
1.06	0.040	0.031	0.108	0.276	-.035	0.059	-.040	0.829	1.062
1.08	0.040	0.031	0.112	0.263	-.033	0.063	-.042	0.834	1.082
1.10	0.040	0.030	0.116	0.252	-.032	0.067	-.043	0.839	1.102

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.053	0.071	0.599	-.076	0.012	-.022	0.471	0.902
0.92	0.060	0.053	0.075	0.577	-.072	0.015	-.024	0.531	0.922
0.94	0.060	0.053	0.079	0.555	-.069	0.018	-.026	0.579	0.942
0.96	0.060	0.052	0.083	0.533	-.066	0.022	-.028	0.617	0.962
0.98	0.060	0.052	0.087	0.512	-.063	0.025	-.029	0.650	0.982
1.00	0.060	0.052	0.091	0.492	-.060	0.029	-.031	0.676	1.002
1.02	0.060	0.051	0.096	0.473	-.058	0.032	-.033	0.698	1.022
1.04	0.060	0.051	0.100	0.455	-.056	0.036	-.035	0.716	1.042
1.06	0.060	0.051	0.104	0.438	-.053	0.039	-.037	0.732	1.062
1.08	0.060	0.050	0.109	0.421	-.051	0.043	-.039	0.746	1.082
1.10	0.060	0.050	0.113	0.405	-.049	0.047	-.040	0.759	1.102

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.073	0.064	0.753	-.103	-.008	-.015	0.469	0.902
0.92	0.080	0.073	0.068	0.729	-.098	-.005	-.017	0.265	0.922
0.94	0.080	0.072	0.073	0.706	-.094	-.001	-.019	0.076	0.942
0.96	0.080	0.072	0.077	0.684	-.090	0.002	-.021	0.084	0.962
0.98	0.080	0.072	0.081	0.662	-.086	0.005	-.024	0.216	0.982
1.00	0.080	0.072	0.086	0.641	-.082	0.009	-.026	0.322	1.002
1.02	0.080	0.071	0.090	0.619	-.079	0.012	-.028	0.407	1.022
1.04	0.080	0.071	0.095	0.599	-.075	0.016	-.030	0.473	1.042
1.06	0.080	0.071	0.099	0.579	-.073	0.020	-.032	0.525	1.062
1.08	0.080	0.070	0.104	0.560	-.070	0.023	-.034	0.568	1.082
1.10	0.080	0.070	0.109	0.541	-.067	0.027	-.036	0.604	1.102

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.093	0.054	0.864	-.133	-.028	-.005	0.982	0.902
0.92	0.100	0.093	0.059	0.843	-.126	-.025	-.008	0.951	0.922
0.94	0.100	0.092	0.064	0.823	-.120	-.021	-.011	0.895	0.942
0.96	0.100	0.092	0.069	0.802	-.115	-.018	-.013	0.808	0.962
0.98	0.100	0.092	0.074	0.781	-.109	-.015	-.016	0.683	0.982
1.00	0.100	0.092	0.078	0.760	-.105	-.011	-.018	0.524	1.002
1.02	0.100	0.091	0.083	0.739	-.100	-.008	-.021	0.347	1.022
1.04	0.100	0.091	0.088	0.718	-.096	-.004	-.023	0.171	1.042
1.06	0.100	0.090	0.093	0.697	-.092	-.000	-.025	0.008	1.062
1.08	0.100	0.090	0.098	0.678	-.088	0.004	-.028	0.127	1.082
1.10	0.100	0.090	0.103	0.658	-.085	0.007	-.030	0.239	1.103

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.113	0.041	0.939	-.165	-.048	0.007	0.988	0.901
0.92	0.120	0.112	0.047	0.923	-.156	-.044	0.004	0.996	0.922
0.94	0.120	0.112	0.053	0.906	-.148	-.041	0.001	1.000	0.942
0.96	0.120	0.112	0.058	0.888	-.141	-.038	-.002	0.998	0.962
0.98	0.120	0.112	0.063	0.870	-.134	-.034	-.006	0.987	0.982
1.00	0.120	0.111	0.069	0.851	-.128	-.031	-.008	0.964	1.002
1.02	0.120	0.111	0.074	0.832	-.123	-.027	-.011	0.924	1.022
1.04	0.120	0.111	0.079	0.813	-.117	-.024	-.014	0.859	1.042
1.06	0.120	0.110	0.085	0.794	-.113	-.020	-.017	0.765	1.062
1.08	0.120	0.110	0.090	0.774	-.108	-.016	-.020	0.637	1.082
1.10	0.120	0.110	0.095	0.755	-.104	-.012	-.022	0.487	1.103

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.132	0.024	0.983	-.202	-.068	0.024	0.941	0.900
0.92	0.140	0.132	0.031	0.973	-.190	-.064	0.019	0.957	0.921
0.94	0.140	0.132	0.038	0.961	-.180	-.061	0.015	0.971	0.941
0.96	0.140	0.132	0.044	0.948	-.170	-.058	0.011	0.982	0.961
0.98	0.140	0.131	0.051	0.933	-.162	-.054	0.007	0.991	0.982
1.00	0.140	0.131	0.057	0.918	-.154	-.051	0.004	0.998	1.002
1.02	0.140	0.131	0.063	0.902	-.147	-.047	0.000	1.000	1.022
1.04	0.140	0.131	0.069	0.885	-.140	-.044	-.003	0.997	1.042
1.06	0.140	0.130	0.074	0.868	-.134	-.040	-.007	0.986	1.062
1.08	0.140	0.130	0.080	0.851	-.128	-.036	-.010	0.965	1.082
1.10	0.140	0.130	0.086	0.833	-.123	-.032	-.013	0.928	1.102

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.152	0.002	1.000	-.247	-.087	0.047	0.882	0.899
0.92	0.160	0.152	0.011	0.997	-.230	-.084	0.040	0.904	0.919
0.94	0.160	0.152	0.019	0.992	-.216	-.081	0.034	0.923	0.940
0.96	0.160	0.151	0.027	0.984	-.203	-.078	0.028	0.940	0.960
0.98	0.160	0.151	0.035	0.975	-.192	-.074	0.023	0.954	0.981
1.00	0.160	0.151	0.042	0.964	-.182	-.071	0.018	0.968	1.001
1.02	0.160	0.151	0.049	0.952	-.173	-.067	0.014	0.979	1.021
1.04	0.160	0.150	0.055	0.938	-.165	-.063	0.010	0.988	1.042
1.06	0.160	0.150	0.062	0.924	-.157	-.060	0.006	0.995	1.062
1.08	0.160	0.150	0.068	0.910	-.150	-.056	0.002	0.999	1.082
1.10	0.160	0.149	0.075	0.895	-.144	-.052	-.002	0.999	1.102

TABLE B-IX, cont.

ORIGINAL PAGE IS
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DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.180	0.171	-.032	0.983	-.311	-.107	0.080	0.802	0.896
0.92	0.180	0.171	-.018	0.995	-.283	-.104	0.060	0.837	0.917
0.94	0.180	0.171	-.006	0.999	-.261	-.101	0.059	0.865	0.938
0.96	0.180	0.171	0.005	1.000	-.242	-.097	0.050	0.888	0.959
0.98	0.180	0.171	0.014	0.997	-.227	-.094	0.043	0.908	0.979
1.00	0.180	0.170	0.023	0.991	-.214	-.090	0.037	0.925	1.000
1.02	0.180	0.170	0.031	0.984	-.202	-.087	0.031	0.941	1.020
1.04	0.180	0.170	0.039	0.975	-.192	-.083	0.026	0.955	1.041
1.06	0.180	0.170	0.047	0.964	-.182	-.080	0.021	0.967	1.061
1.08	0.180	0.169	0.054	0.953	-.174	-.076	0.016	0.978	1.081
1.10	0.180	0.169	0.061	0.941	-.166	-.072	0.012	0.987	1.102

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.92	0.200	0.190	-.067	0.944	-.374	-.124	0.116	0.728	0.913
0.94	0.200	0.190	-.043	0.976	-.326	-.121	0.095	0.784	0.935
0.96	0.200	0.190	-.026	0.991	-.295	-.117	0.081	0.822	0.956
0.98	0.200	0.190	-.013	0.998	-.271	-.114	0.070	0.851	0.977
1.00	0.200	0.190	-.001	1.000	-.252	-.110	0.061	0.875	0.998
1.02	0.200	0.190	0.009	0.999	-.236	-.107	0.053	0.896	1.019
1.04	0.200	0.190	0.019	0.995	-.223	-.103	0.046	0.914	1.040
1.06	0.200	0.189	0.028	0.989	-.210	-.099	0.039	0.930	1.060
1.08	0.200	0.189	0.037	0.982	-.200	-.096	0.033	0.944	1.080
1.10	0.200	0.189	0.045	0.973	-.190	-.092	0.028	0.957	1.101

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.013	0.078	0.168	-.023	0.056	-.026	0.908	0.900
0.92	0.020	0.013	0.082	0.158	-.022	0.059	-.028	0.902	0.921
0.94	0.020	0.013	0.086	0.148	-.021	0.061	-.030	0.896	0.941
0.96	0.020	0.013	0.089	0.139	-.020	0.063	-.032	0.890	0.961
0.98	0.020	0.012	0.093	0.130	-.019	0.066	-.035	0.884	0.981
1.00	0.020	0.012	0.097	0.122	-.018	0.068	-.037	0.878	1.001
1.02	0.020	0.012	0.101	0.114	-.018	0.071	-.040	0.872	1.021
1.04	0.020	0.011	0.105	0.107	-.017	0.073	-.042	0.867	1.041
1.06	0.020	0.011	0.109	0.099	-.016	0.076	-.045	0.861	1.061
1.08	0.020	0.011	0.114	0.093	-.015	0.078	-.047	0.855	1.082
1.10	0.020	0.010	0.118	0.087	-.015	0.080	-.050	0.850	1.102

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.033	0.076	0.403	-.049	0.037	-.023	0.843	0.901
0.92	0.040	0.033	0.079	0.384	-.047	0.039	-.026	0.835	0.921
0.94	0.040	0.033	0.083	0.366	-.045	0.041	-.028	0.828	0.941
0.96	0.040	0.032	0.087	0.349	-.043	0.044	-.030	0.822	0.961
0.98	0.040	0.032	0.091	0.332	-.041	0.046	-.033	0.816	0.981
1.00	0.040	0.032	0.095	0.317	-.039	0.048	-.035	0.809	1.002
1.02	0.040	0.032	0.099	0.303	-.038	0.051	-.038	0.804	1.022
1.04	0.040	0.031	0.103	0.289	-.036	0.053	-.040	0.798	1.042
1.06	0.040	0.031	0.108	0.276	-.035	0.056	-.043	0.792	1.062
1.08	0.040	0.031	0.112	0.263	-.033	0.058	-.046	0.787	1.082
1.10	0.040	0.030	0.116	0.251	-.032	0.061	-.048	0.782	1.102

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.053	0.071	0.601	-.076	0.017	-.018	0.668	0.901
0.92	0.060	0.053	0.075	0.577	-.072	0.019	-.021	0.671	0.922
0.94	0.060	0.053	0.079	0.555	-.069	0.021	-.023	0.672	0.942
0.96	0.060	0.052	0.083	0.534	-.066	0.024	-.026	0.673	0.962
0.98	0.060	0.052	0.087	0.512	-.063	0.026	-.029	0.674	0.982
1.00	0.060	0.052	0.091	0.492	-.060	0.028	-.031	0.675	1.002
1.02	0.060	0.051	0.096	0.473	-.058	0.031	-.034	0.673	1.022
1.04	0.060	0.051	0.100	0.455	-.056	0.033	-.037	0.672	1.042
1.06	0.060	0.051	0.104	0.437	-.053	0.036	-.040	0.671	1.062
1.08	0.060	0.050	0.109	0.420	-.051	0.038	-.042	0.670	1.083
1.10	0.060	0.050	0.113	0.404	-.049	0.041	-.045	0.669	1.102

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.073	0.064	0.754	-.103	-.003	-.011	0.273	0.901
0.92	0.080	0.073	0.068	0.730	-.098	-.001	-.014	0.063	0.922
0.94	0.080	0.072	0.073	0.707	-.094	0.002	-.017	0.088	0.942
0.96	0.080	0.072	0.077	0.685	-.090	0.004	-.020	0.188	0.962
0.98	0.080	0.072	0.081	0.662	-.086	0.006	-.023	0.262	0.982
1.00	0.080	0.072	0.086	0.641	-.082	0.009	-.026	0.317	1.002
1.02	0.080	0.071	0.090	0.619	-.079	0.011	-.029	0.361	1.022
1.04	0.080	0.071	0.095	0.599	-.075	0.013	-.032	0.392	1.043
1.06	0.080	0.071	0.100	0.579	-.072	0.016	-.035	0.418	1.063
1.08	0.080	0.070	0.104	0.559	-.070	0.018	-.038	0.438	1.083
1.10	0.080	0.070	0.109	0.541	-.067	0.021	-.041	0.455	1.103

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.093	0.054	0.864	-.133	-.023	-.002	0.998	0.901
0.92	0.100	0.093	0.059	0.844	-.126	-.021	-.005	0.972	0.921
0.94	0.100	0.092	0.064	0.823	-.120	-.018	-.008	0.912	0.942
0.96	0.100	0.092	0.069	0.802	-.115	-.016	-.012	0.810	0.962
0.98	0.100	0.092	0.074	0.781	-.109	-.014	-.015	0.676	0.982
1.00	0.100	0.092	0.078	0.759	-.105	-.011	-.018	0.526	1.002
1.02	0.100	0.091	0.083	0.739	-.100	-.009	-.021	0.381	1.023
1.04	0.100	0.091	0.088	0.718	-.096	-.006	-.025	0.251	1.043
1.06	0.100	0.090	0.093	0.697	-.092	-.004	-.028	0.137	1.063
1.08	0.100	0.090	0.098	0.677	-.088	-.001	-.031	0.046	1.083
1.10	0.100	0.090	0.103	0.657	-.085	0.001	-.035	0.029	1.103

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.113	0.041	0.939	-.165	-.043	0.011	0.967	0.901
0.92	0.120	0.112	0.047	0.923	-.156	-.041	0.007	0.985	0.921
0.94	0.120	0.112	0.052	0.906	-.148	-.038	0.003	0.997	0.941
0.96	0.120	0.112	0.058	0.888	-.141	-.036	-.001	1.000	0.962
0.98	0.120	0.112	0.063	0.870	-.134	-.033	-.005	0.990	0.982
1.00	0.120	0.111	0.069	0.851	-.128	-.031	-.009	0.964	1.002
1.02	0.120	0.111	0.074	0.832	-.123	-.029	-.012	0.918	1.022
1.04	0.120	0.111	0.079	0.812	-.117	-.026	-.016	0.852	1.043
1.06	0.120	0.110	0.085	0.793	-.112	-.024	-.020	0.769	1.063
1.08	0.120	0.110	0.090	0.774	-.108	-.021	-.024	0.672	1.083
1.10	0.120	0.110	0.095	0.754	-.104	-.019	-.027	0.567	1.103

TABLE B-IX, cont.

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
LIGHT LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.132	0.024	0.984	-.202	-.061	0.029	0.912	0.900
0.92	0.140	0.132	0.031	0.973	-.190	-.060	0.025	0.936	0.920
0.94	0.140	0.132	0.038	0.961	-.180	-.058	0.018	0.957	0.941
0.96	0.140	0.132	0.044	0.948	-.170	-.056	0.013	0.975	0.961
0.98	0.140	0.131	0.051	0.935	-.162	-.053	0.008	0.989	0.981
1.00	0.140	0.131	0.057	0.918	-.154	-.051	0.003	0.999	1.002
1.02	0.140	0.131	0.063	0.902	-.147	-.048	-.001	1.000	1.022
1.04	0.140	0.131	0.069	0.885	-.140	-.046	-.005	0.993	1.042
1.06	0.140	0.130	0.074	0.868	-.134	-.044	-.010	0.977	1.063
1.08	0.140	0.130	0.080	0.851	-.128	-.041	-.014	0.948	1.083
1.10	0.140	0.130	0.086	0.833	-.123	-.039	-.018	0.907	1.103

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.152	0.001	1.000	-.246	-.082	0.051	0.852	0.898
0.92	0.160	0.152	0.011	0.998	-.231	-.080	0.043	0.881	0.919
0.94	0.160	0.152	0.019	0.992	-.216	-.078	0.036	0.906	0.939
0.96	0.160	0.151	0.027	0.984	-.203	-.075	0.030	0.930	0.960
0.98	0.160	0.151	0.035	0.975	-.192	-.073	0.024	0.950	0.981
1.00	0.160	0.151	0.042	0.964	-.182	-.071	0.018	0.968	1.001
1.02	0.160	0.151	0.049	0.952	-.173	-.068	0.013	0.982	1.021
1.04	0.160	0.150	0.055	0.938	-.164	-.066	0.008	0.993	1.042
1.06	0.160	0.150	0.062	0.924	-.157	-.063	0.003	0.999	1.062
1.08	0.160	0.150	0.068	0.909	-.150	-.061	-.002	0.999	1.083
1.10	0.160	0.149	0.075	0.894	-.143	-.058	-.007	0.994	1.103

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.180	0.171	-.032	0.983	-.312	-.102	0.084	0.772	0.895
0.92	0.180	0.171	-.018	0.995	-.283	-.100	0.071	0.813	0.916
0.94	0.180	0.171	-.006	0.999	-.261	-.098	0.061	0.847	0.938
0.96	0.180	0.171	0.005	1.000	-.243	-.095	0.052	0.877	0.959
0.98	0.180	0.171	0.014	0.997	-.227	-.093	0.044	0.902	0.979
1.00	0.180	0.170	0.023	0.991	-.214	-.090	0.037	0.925	1.000
1.02	0.180	0.170	0.031	0.984	-.202	-.088	0.030	0.945	1.021
1.04	0.180	0.170	0.039	0.974	-.191	-.086	0.024	0.963	1.041
1.06	0.180	0.170	0.047	0.964	-.182	-.083	0.018	0.977	1.061
1.08	0.180	0.169	0.054	0.953	-.173	-.081	0.012	0.989	1.082
1.10	0.180	0.169	0.061	0.940	-.166	-.078	0.007	0.996	1.102

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.92	0.200	0.190	-.067	0.943	-.376	-.119	0.121	0.704	0.912
0.94	0.200	0.190	-.043	0.975	-.327	-.117	0.098	0.766	0.934
0.96	0.200	0.190	-.027	0.990	-.295	-.115	0.083	0.810	0.956
0.98	0.200	0.190	-.013	0.998	-.272	-.113	0.071	0.845	0.977
1.00	0.200	0.190	-.001	1.000	-.252	-.110	0.061	0.875	0.998
1.02	0.200	0.190	0.009	0.999	-.236	-.108	0.052	0.900	1.019
1.04	0.200	0.190	0.019	0.995	-.222	-.105	0.044	0.923	1.040
1.06	0.200	0.189	0.028	0.989	-.210	-.103	0.036	0.943	1.060
1.08	0.200	0.189	0.037	0.981	-.199	-.101	0.029	0.960	1.081
1.10	0.200	0.189	0.045	0.973	-.190	-.098	0.023	0.974	1.101

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TABLE B-X

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
HEAVY LOAD CASE

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.014	0.066	0.211	-.028	0.538	0.348	0.840	0.831
0.92	0.020	0.014	0.070	0.199	-.026	0.563	0.363	0.840	0.849
0.94	0.020	0.014	0.073	0.188	-.025	0.589	0.379	0.841	0.868
0.96	0.020	0.014	0.076	0.177	-.024	0.615	0.395	0.841	0.886
0.98	0.020	0.013	0.079	0.167	-.023	0.641	0.412	0.841	0.905
1.00	0.020	0.013	0.082	0.156	-.022	0.669	0.429	0.842	0.923
1.02	0.020	0.013	0.086	0.147	-.021	0.697	0.446	0.842	0.942
1.04	0.020	0.013	0.089	0.139	-.020	0.725	0.464	0.842	0.960
1.06	0.020	0.012	0.093	0.131	-.019	0.754	0.482	0.843	0.978
1.08	0.020	0.012	0.096	0.123	-.019	0.783	0.500	0.843	0.997
1.10	0.020	0.012	0.100	0.115	-.018	0.813	0.519	0.843	1.015

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.034	0.063	0.476	-.058	0.519	0.352	0.828	0.832
0.92	0.040	0.034	0.067	0.456	-.056	0.544	0.367	0.829	0.850
0.94	0.040	0.034	0.070	0.436	-.053	0.570	0.382	0.830	0.869
0.96	0.040	0.034	0.073	0.417	-.051	0.596	0.399	0.831	0.887
0.98	0.040	0.033	0.077	0.399	-.049	0.622	0.415	0.832	0.905
1.00	0.040	0.033	0.080	0.382	-.047	0.650	0.432	0.833	0.924
1.02	0.040	0.033	0.084	0.365	-.045	0.678	0.449	0.833	0.942
1.04	0.040	0.032	0.087	0.350	-.043	0.706	0.467	0.834	0.961
1.06	0.040	0.032	0.091	0.335	-.041	0.735	0.485	0.835	0.979
1.08	0.040	0.032	0.094	0.321	-.040	0.764	0.503	0.835	0.998
1.10	0.040	0.032	0.098	0.307	-.038	0.794	0.521	0.836	1.016

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.054	0.058	0.686	-.090	0.500	0.358	0.813	0.832
0.92	0.060	0.054	0.061	0.662	-.086	0.525	0.373	0.815	0.850
0.94	0.060	0.054	0.065	0.639	-.082	0.550	0.388	0.817	0.869
0.96	0.060	0.053	0.068	0.617	-.078	0.577	0.404	0.819	0.887
0.98	0.060	0.053	0.072	0.595	-.075	0.603	0.421	0.820	0.906
1.00	0.060	0.053	0.075	0.574	-.072	0.631	0.437	0.822	0.924
1.02	0.060	0.053	0.079	0.554	-.069	0.658	0.454	0.823	0.943
1.04	0.060	0.052	0.083	0.534	-.066	0.687	0.471	0.824	0.961
1.06	0.060	0.052	0.087	0.515	-.063	0.716	0.489	0.826	0.980
1.08	0.060	0.052	0.091	0.497	-.061	0.745	0.507	0.827	0.998
1.10	0.060	0.052	0.094	0.479	-.059	0.775	0.525	0.828	1.016

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.074	0.049	0.835	-.124	0.480	0.367	0.795	0.832
0.92	0.080	0.074	0.053	0.813	-.118	0.505	0.381	0.798	0.851
0.94	0.080	0.074	0.057	0.791	-.112	0.531	0.396	0.801	0.869
0.96	0.080	0.073	0.061	0.770	-.107	0.557	0.412	0.804	0.888
0.98	0.080	0.073	0.065	0.748	-.102	0.584	0.428	0.807	0.906
1.00	0.080	0.073	0.069	0.727	-.098	0.611	0.444	0.809	0.925
1.02	0.080	0.073	0.073	0.706	-.094	0.639	0.461	0.811	0.943
1.04	0.080	0.072	0.077	0.685	-.090	0.667	0.478	0.813	0.961
1.06	0.080	0.072	0.081	0.665	-.086	0.696	0.495	0.815	0.980
1.08	0.080	0.072	0.085	0.645	-.083	0.726	0.513	0.817	0.998
1.10	0.080	0.071	0.089	0.625	-.080	0.756	0.531	0.818	1.017

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DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.094	0.037	0.931	-.160	0.460	0.378	0.772	0.832
0.92	0.100	0.094	0.041	0.914	-.152	0.485	0.392	0.777	0.850
0.94	0.100	0.093	0.046	0.897	-.145	0.511	0.407	0.782	0.869
0.96	0.100	0.093	0.051	0.878	-.138	0.537	0.422	0.786	0.887
0.98	0.100	0.093	0.055	0.860	-.131	0.564	0.437	0.790	0.906
1.00	0.100	0.093	0.060	0.840	-.125	0.591	0.453	0.794	0.925
1.02	0.100	0.092	0.064	0.821	-.120	0.619	0.469	0.797	0.943
1.04	0.100	0.092	0.069	0.802	-.115	0.648	0.486	0.800	0.962
1.06	0.100	0.092	0.073	0.783	-.110	0.677	0.503	0.802	0.980
1.08	0.100	0.092	0.077	0.763	-.105	0.706	0.521	0.805	0.999
1.10	0.100	0.091	0.082	0.744	-.101	0.736	0.539	0.807	1.017

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.113	0.020	0.985	-.204	0.439	0.394	0.744	0.831
0.92	0.120	0.113	0.026	0.975	-.192	0.464	0.407	0.752	0.850
0.94	0.120	0.113	0.032	0.963	-.181	0.490	0.421	0.759	0.868
0.96	0.120	0.113	0.037	0.950	-.171	0.517	0.435	0.765	0.887
0.98	0.120	0.113	0.043	0.936	-.163	0.544	0.450	0.771	0.906
1.00	0.120	0.112	0.048	0.920	-.155	0.571	0.465	0.776	0.924
1.02	0.120	0.112	0.053	0.905	-.148	0.599	0.481	0.780	0.943
1.04	0.120	0.112	0.058	0.888	-.141	0.627	0.497	0.784	0.961
1.06	0.120	0.112	0.063	0.872	-.135	0.657	0.513	0.788	0.980
1.08	0.120	0.111	0.068	0.854	-.129	0.686	0.530	0.791	0.998
1.10	0.120	0.111	0.073	0.837	-.124	0.716	0.548	0.794	1.017

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.133	-.004	1.000	-.258	0.417	0.416	0.708	0.829
0.92	0.140	0.133	0.005	0.999	-.240	0.443	0.427	0.720	0.848
0.94	0.140	0.133	0.012	0.996	-.224	0.469	0.439	0.730	0.867
0.96	0.140	0.133	0.019	0.990	-.211	0.495	0.452	0.739	0.886
0.98	0.140	0.132	0.026	0.981	-.199	0.523	0.465	0.747	0.905
1.00	0.140	0.132	0.032	0.971	-.188	0.550	0.479	0.754	0.924
1.02	0.140	0.132	0.038	0.960	-.179	0.578	0.494	0.760	0.942
1.04	0.140	0.132	0.044	0.948	-.170	0.607	0.510	0.766	0.961
1.06	0.140	0.131	0.050	0.935	-.162	0.636	0.526	0.771	0.979
1.08	0.140	0.131	0.056	0.921	-.155	0.666	0.542	0.775	0.998
1.10	0.140	0.131	0.061	0.906	-.148	0.696	0.559	0.780	1.017

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.152	-.043	0.962	-.347	0.393	0.452	0.656	0.826
0.92	0.160	0.152	-.027	0.984	-.309	0.420	0.456	0.677	0.846
0.94	0.160	0.152	-.015	0.995	-.282	0.447	0.464	0.693	0.865
0.96	0.160	0.152	-.005	0.999	-.260	0.474	0.474	0.707	0.884
0.98	0.160	0.152	0 004	1.000	-.243	0.501	0.486	0.718	0.903
1.00	0.160	0.152	0.012	0.997	-.228	0.529	0.498	0.728	0.922
1.02	0.160	0.152	0.020	0.992	-.215	0.557	0.512	0.736	0.941
1.04	0.160	0.151	0.027	0.984	-.203	0.586	0.526	0.744	0.960
1.06	0.160	0.151	0.034	0.976	-.193	0.615	0.541	0.751	0.979
1.08	0.160	0.151	0.040	0.966	-.184	0.645	0.557	0.757	0.998
1.10	0.160	0.151	0.047	0.955	-.175	0.676	0.573	0.763	1.016

TABLE B-X, cont.

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.94	0.180	0.171	-.067	0.952	-.391	0.421	0.511	0.636	0.861
0.96	0.180	0.171	-.043	0.970	-.336	0.450	0.509	0.662	0.881
0.98	0.180	0.171	-.028	0.987	-.303	0.478	0.515	0.681	0.901
1.00	0.180	0.171	-.015	0.996	-.279	0.507	0.524	0.695	0.921
1.02	0.180	0.171	-.005	1.000	-.259	0.535	0.535	0.708	0.940
1.04	0.180	0.171	0.005	1.000	-.242	0.565	0.547	0.718	0.959
1.06	0.180	0.171	0.013	0.997	-.228	0.594	0.560	0.728	0.978
1.08	0.180	0.171	0.021	0.992	-.216	0.624	0.574	0.736	0.997
1.10	0.180	0.170	0.029	0.986	-.205	0.655	0.589	0.743	1.015

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
1.00	0.200	0.190	-.061	0.953	-.362	0.482	0.565	0.649	0.917
1.02	0.200	0.190	-.041	0.978	-.322	0.512	0.568	0.670	0.937
1.04	0.200	0.190	-.026	0.991	-.294	0.542	0.575	0.686	0.957
1.06	0.200	0.190	-.014	0.997	-.273	0.572	0.585	0.699	0.976
1.08	0.200	0.190	-.003	1.000	-.255	0.602	0.597	0.710	0.995
1.10	0.200	0.190	0.007	0.999	-.240	0.633	0.610	0.720	1.014

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.020	0.015	0.065	0.219	-.029	0.604	0.399	0.834	0.820
0.92	0.020	0.014	0.068	0.205	-.027	0.623	0.410	0.835	0.840
0.94	0.020	0.014	0.071	0.193	-.026	0.643	0.422	0.836	0.859
0.96	0.020	0.014	0.075	0.181	-.025	0.663	0.433	0.837	0.879
0.98	0.020	0.013	0.078	0.170	-.023	0.683	0.444	0.838	0.899
1.00	0.020	0.013	0.082	0.159	-.022	0.703	0.455	0.839	0.918
1.02	0.020	0.013	0.085	0.150	-.021	0.723	0.467	0.840	0.938
1.04	0.020	0.013	0.089	0.140	-.020	0.743	0.478	0.841	0.957
1.06	0.020	0.012	0.093	0.132	-.019	0.764	0.490	0.842	0.977
1.08	0.020	0.012	0.096	0.123	-.019	0.785	0.501	0.843	0.997
1.10	0.020	0.012	0.100	0.116	-.018	0.805	0.513	0.844	1.016

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.040	0.034	0.061	0.489	-.060	0.585	0.403	0.823	0.821
0.92	0.040	0.034	0.065	0.466	-.057	0.604	0.414	0.825	0.841
0.94	0.040	0.034	0.068	0.444	-.054	0.624	0.425	0.826	0.860
0.96	0.040	0.034	0.072	0.424	-.052	0.644	0.436	0.828	0.880
0.98	0.040	0.033	0.075	0.404	-.049	0.664	0.447	0.829	0.899
1.00	0.040	0.033	0.079	0.386	-.047	0.684	0.458	0.831	0.919
1.02	0.040	0.033	0.083	0.368	-.045	0.704	0.470	0.832	0.939
1.04	0.040	0.032	0.087	0.351	-.043	0.724	0.481	0.833	0.958
1.06	0.040	0.032	0.090	0.336	-.041	0.745	0.492	0.834	0.978
1.08	0.040	0.032	0.094	0.320	-.040	0.765	0.504	0.835	0.997
1.10	0.040	0.032	0.098	0.306	-.038	0.786	0.515	0.836	1.017

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
HEAVY LOAD CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.060	0.054	0.056	0.699	-.092	0.565	0.409	0.810	0.821
0.92	0.060	0.054	0.059	0.674	-.088	0.585	0.420	0.812	0.841
0.94	0.060	0.054	0.063	0.649	-.084	0.604	0.431	0.814	0.861
0.96	0.060	0.054	0.067	0.625	-.080	0.624	0.441	0.816	0.880
0.98	0.060	0.053	0.071	0.602	-.076	0.644	0.452	0.818	0.900
1.00	0.060	0.053	0.074	0.580	-.073	0.664	0.463	0.820	0.919
1.02	0.060	0.053	0.078	0.558	-.069	0.684	0.474	0.822	0.939
1.04	0.060	0.052	0.082	0.536	-.066	0.705	0.485	0.824	0.959
1.06	0.060	0.052	0.086	0.516	-.064	0.725	0.497	0.825	0.978
1.08	0.060	0.052	0.091	0.496	-.061	0.746	0.508	0.827	0.993
1.10	0.060	0.051	0.095	0.478	-.058	0.767	0.519	0.828	1.018

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.080	0.074	0.047	0.847	-.127	0.545	0.418	0.794	0.821
0.92	0.080	0.074	0.051	0.824	-.121	0.565	0.428	0.797	0.841
0.94	0.080	0.074	0.055	0.801	-.114	0.585	0.439	0.800	0.861
0.96	0.080	0.073	0.059	0.778	-.109	0.604	0.449	0.803	0.880
0.98	0.080	0.073	0.063	0.755	-.104	0.624	0.460	0.805	0.900
1.00	0.080	0.073	0.068	0.732	-.099	0.645	0.470	0.808	0.720
1.02	0.080	0.073	0.072	0.710	-.094	0.665	0.481	0.810	0.939
1.04	0.080	0.072	0.076	0.688	-.090	0.685	0.492	0.812	0.959
1.06	0.080	0.072	0.081	0.666	-.086	0.706	0.503	0.814	0.979
1.08	0.080	0.072	0.085	0.645	-.083	0.726	0.514	0.817	0.998
1.10	0.080	0.071	0.089	0.624	-.079	0.747	0.525	0.818	1.018

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.100	0.094	0.034	0.940	-.166	0.525	0.430	0.773	0.821
0.92	0.100	0.094	0.039	0.923	-.156	0.545	0.440	0.778	0.841
0.94	0.100	0.093	0.044	0.905	-.148	0.565	0.450	0.782	0.860
0.96	0.100	0.093	0.049	0.886	-.140	0.585	0.459	0.786	0.880
0.98	0.100	0.093	0.054	0.866	-.133	0.605	0.469	0.790	0.900
1.00	0.100	0.093	0.058	0.846	-.127	0.625	0.480	0.793	0.920
1.02	0.100	0.092	0.063	0.825	-.121	0.645	0.490	0.796	0.939
1.04	0.100	0.092	0.068	0.805	-.115	0.666	0.500	0.799	0.959
1.06	0.100	0.092	0.073	0.784	-.110	0.686	0.511	0.802	0.979
1.08	0.100	0.092	0.077	0.764	-.106	0.707	0.521	0.805	0.998
1.10	0.100	0.091	0.082	0.743	-.101	0.728	0.532	0.807	1.018

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.120	0.114	0.016	0.990	-.211	0.505	0.447	0.748	0.820
0.92	0.120	0.113	0.023	0.980	-.198	0.524	0.455	0.755	0.840
0.94	0.120	0.113	0.029	0.968	-.186	0.544	0.464	0.761	0.860
0.96	0.120	0.113	0.035	0.955	-.175	0.564	0.473	0.766	0.880
0.98	0.120	0.113	0.041	0.940	-.166	0.584	0.482	0.771	0.899
1.00	0.120	0.112	0.046	0.925	-.157	0.605	0.491	0.776	0.919
1.02	0.120	0.112	0.052	0.908	-.149	0.625	0.501	0.780	0.939
1.04	0.120	0.112	0.057	0.891	-.142	0.645	0.511	0.784	0.959
1.06	0.120	0.112	0.062	0.873	-.136	0.666	0.521	0.788	0.979
1.08	0.120	0.111	0.068	0.854	-.129	0.687	0.531	0.791	0.998
1.10	0.120	0.111	0.073	0.836	-.124	0.708	0.541	0.794	1.018

TABLE B-X, cont.

DATA FOR INDUCTION MACHINE, POWER FACTOR CORRECTED
HEAVY LOAD CASE

ORIGINAL PAGE IS
OF POOR QUALITY

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.140	0.133	-.009	0.998	-.271	0.483	0.471	0.716	0.818
0.92	0.140	0.133	0.001	1.000	-.249	0.503	0.477	0.726	0.838
0.94	0.140	0.133	0.009	0.998	-.231	0.523	0.483	0.735	0.859
0.96	0.140	0.133	0.017	0.992	-.216	0.544	0.490	0.742	0.879
0.98	0.140	0.132	0.024	0.984	-.203	0.564	0.498	0.749	0.899
1.00	0.140	0.132	0.031	0.974	-.191	0.584	0.507	0.756	0.919
1.02	0.140	0.132	0.037	0.963	-.181	0.605	0.515	0.761	0.938
1.04	0.140	0.132	0.043	0.950	-.171	0.625	0.524	0.766	0.958
1.06	0.140	0.131	0.050	0.936	-.163	0.646	0.533	0.771	0.978
1.08	0.140	0.131	0.056	0.921	-.155	0.667	0.543	0.775	0.998
1.10	0.140	0.131	0.061	0.905	-.148	0.688	0.552	0.780	1.018

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.90	0.160	0.152	-.056	0.938	-.383	0.460	0.515	0.666	0.814
0.92	0.160	0.152	-.035	0.975	-.327	0.481	0.510	0.686	0.835
0.94	0.160	0.152	-.020	0.991	-.293	0.502	0.511	0.701	0.856
0.96	0.160	0.152	-.009	0.998	-.268	0.522	0.515	0.712	0.877
0.98	0.160	0.152	0.001	1.000	-.248	0.543	0.520	0.722	0.897
1.00	0.160	0.152	0.010	0.998	-.232	0.563	0.526	0.731	0.917
1.02	0.160	0.152	0.018	0.993	-.217	0.584	0.533	0.738	0.937
1.04	0.160	0.151	0.026	0.986	-.205	0.605	0.541	0.745	0.957
1.06	0.160	0.151	0.033	0.976	-.194	0.626	0.549	0.752	0.977
1.08	0.160	0.151	0.040	0.966	-.184	0.646	0.558	0.757	0.997
1.10	0.160	0.151	0.047	0.954	-.175	0.667	0.566	0.763	1.017

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
0.96	0.180	0.171	-.051	0.958	-.354	0.499	0.554	0.669	0.873
0.98	0.180	0.171	-.033	0.982	-.313	0.521	0.552	0.686	0.895
1.00	0.180	0.171	-.019	0.994	-.285	0.542	0.553	0.700	0.915
1.02	0.180	0.171	-.007	0.999	-.263	0.563	0.557	0.711	0.936
1.04	0.180	0.171	0.003	1.000	-.245	0.584	0.563	0.720	0.956
1.06	0.180	0.171	0.013	0.997	-.229	0.605	0.569	0.728	0.976
1.08	0.180	0.170	0.021	0.992	-.216	0.626	0.576	0.736	0.996
1.10	0.180	0.170	0.030	0.985	-.204	0.647	0.583	0.743	1.016

SYS V	P IN	DSG P	DSG Q	DSG PF	10 * S	SYS P	SYS Q	SYS P F	LOAD V
1.00	0.200	0.190	-.069	0.941	-.379	0.518	0.600	0.654	0.911
1.02	0.200	0.190	-.045	0.974	-.329	0.540	0.593	0.674	0.933
1.04	0.200	0.190	-.028	0.989	-.298	0.562	0.592	0.688	0.954
1.06	0.200	0.190	-.015	0.997	-.274	0.583	0.595	0.700	0.975
1.08	0.200	0.190	-.003	1.000	-.255	0.605	0.599	0.710	0.995
1.10	0.200	0.190	0.007	0.999	-.239	0.626	0.604	0.719	1.015

TABLE B-XI

DATA FOR INVERTER, CEA CONTROL
LIGHT LOAD CASE

CONSTANT IMPEDANCE LOAD

ORIGINAL PAGE IS
OF POOR QUALITY

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.010	0.894	0.044	0.058	0.603	0.891
0.92	0.020	-.010	0.894	0.046	0.060	0.613	0.911
0.94	0.020	-.010	0.894	0.049	0.062	0.623	0.931
0.96	0.020	-.010	0.894	0.052	0.064	0.632	0.951
0.98	0.020	-.010	0.894	0.055	0.067	0.640	0.971
1.00	0.020	-.010	0.894	0.059	0.069	0.647	0.991
1.02	0.020	-.010	0.894	0.062	0.071	0.654	1.010
1.04	0.020	-.010	0.894	0.065	0.074	0.661	1.030
1.06	0.020	-.010	0.894	0.068	0.076	0.667	1.050
1.08	0.020	-.010	0.894	0.072	0.079	0.673	1.070
1.10	0.020	-.010	0.894	0.075	0.081	0.678	1.090

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.020	0.894	0.024	0.068	0.329	0.891
0.92	0.040	-.020	0.894	0.026	0.070	0.354	0.911
0.94	0.040	-.020	0.894	0.029	0.072	0.377	0.931
0.96	0.040	-.020	0.894	0.032	0.074	0.399	0.951
0.98	0.040	-.020	0.894	0.035	0.077	0.420	0.971
1.00	0.040	-.020	0.894	0.038	0.079	0.439	0.990
1.02	0.040	-.020	0.894	0.042	0.081	0.456	1.010
1.04	0.040	-.020	0.894	0.045	0.084	0.473	1.030
1.06	0.040	-.020	0.894	0.048	0.086	0.488	1.050
1.08	0.040	-.020	0.894	0.052	0.089	0.503	1.070
1.10	0.040	-.020	0.894	0.055	0.091	0.516	1.090

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.030	0.894	0.004	0.078	0.045	0.891
0.92	0.060	-.030	0.894	0.006	0.080	0.080	0.911
0.94	0.060	-.030	0.894	0.009	0.082	0.113	0.931
0.96	0.060	-.030	0.894	0.012	0.084	0.144	0.951
0.98	0.060	-.030	0.894	0.015	0.087	0.175	0.970
1.00	0.060	-.030	0.894	0.018	0.089	0.203	0.990
1.02	0.060	-.030	0.894	0.022	0.091	0.231	1.010
1.04	0.060	-.030	0.894	0.025	0.094	0.257	1.030
1.06	0.060	-.030	0.894	0.028	0.096	0.281	1.050
1.08	0.060	-.030	0.894	0.032	0.099	0.304	1.070
1.10	0.060	-.030	0.894	0.035	0.101	0.326	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.040	0.894	-.017	0.088	0.185	0.891
0.92	0.080	-.040	0.894	-.014	0.090	0.150	0.911
0.94	0.080	-.040	0.894	-.011	0.092	0.116	0.931
0.96	0.080	-.040	0.894	-.008	0.094	0.082	0.950
0.98	0.080	-.040	0.894	-.005	0.096	0.049	0.970
1.00	0.080	-.040	0.894	-.002	0.099	0.016	0.990
1.02	0.080	-.040	0.894	0.002	0.101	0.016	1.010
1.04	0.080	-.040	0.894	0.005	0.104	0.047	1.030
1.06	0.080	-.040	0.894	0.008	0.106	0.076	1.050
1.08	0.080	-.040	0.894	0.011	0.109	0.105	1.069
1.10	0.080	-.040	0.894	0.015	0.111	0.133	1.089

DATA FOR INVERTER, CEA CONTROL
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.050	0.894	-.037	0.098	0.351	0.891
0.92	0.100	-.050	0.894	-.034	0.100	0.320	0.910
0.94	0.100	-.050	0.894	-.031	0.102	0.289	0.930
0.96	0.100	-.050	0.894	-.028	0.104	0.258	0.950
0.98	0.100	-.050	0.894	-.025	0.106	0.226	0.970
1.00	0.100	-.050	0.894	-.022	0.109	0.195	0.990
1.02	0.100	-.050	0.894	-.018	0.111	0.164	1.010
1.04	0.100	-.050	0.894	-.015	0.114	0.133	1.030
1.06	0.100	-.050	0.894	-.012	0.116	0.102	1.049
1.08	0.100	-.050	0.894	-.009	0.119	0.072	1.069
1.10	0.100	-.050	0.894	-.005	0.121	0.042	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.060	0.894	-.057	0.108	0.466	0.890
0.92	0.120	-.060	0.894	-.054	0.110	0.440	0.910
0.94	0.120	-.060	0.894	-.051	0.112	0.413	0.930
0.96	0.120	-.060	0.894	-.048	0.114	0.386	0.950
0.98	0.120	-.060	0.894	-.045	0.116	0.359	0.970
1.00	0.120	-.060	0.894	-.042	0.119	0.331	0.990
1.02	0.120	-.060	0.894	-.038	0.121	0.303	1.009
1.04	0.120	-.060	0.894	-.035	0.124	0.274	1.029
1.06	0.120	-.060	0.894	-.032	0.126	0.246	1.049
1.08	0.120	-.060	0.894	-.029	0.129	0.217	1.069
1.10	0.120	-.060	0.894	-.025	0.131	0.188	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.070	0.894	-.077	0.118	0.546	0.890
0.92	0.140	-.070	0.894	-.074	0.120	0.525	0.910
0.94	0.140	-.070	0.894	-.071	0.122	0.502	0.930
0.96	0.140	-.070	0.894	-.068	0.124	0.480	0.950
0.98	0.140	-.070	0.894	-.065	0.126	0.456	0.970
1.00	0.140	-.070	0.894	-.062	0.129	0.432	0.989
1.02	0.140	-.070	0.894	-.059	0.131	0.408	1.009
1.04	0.140	-.070	0.894	-.055	0.134	0.382	1.029
1.06	0.140	-.070	0.894	-.052	0.136	0.357	1.049
1.08	0.140	-.070	0.894	-.049	0.139	0.331	1.069
1.10	0.140	-.070	0.894	-.045	0.141	0.305	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.080	0.894	-.097	0.128	0.604	0.890
0.92	0.160	-.080	0.894	-.094	0.130	0.586	0.910
0.94	0.160	-.080	0.894	-.091	0.132	0.567	0.930
0.96	0.160	-.080	0.894	-.088	0.134	0.548	0.949
0.98	0.160	-.080	0.894	-.085	0.136	0.528	0.969
1.00	0.160	-.080	0.894	-.082	0.139	0.508	0.989
1.02	0.160	-.080	0.894	-.079	0.141	0.486	1.009
1.04	0.160	-.080	0.894	-.075	0.144	0.465	1.029
1.06	0.160	-.080	0.894	-.072	0.146	0.442	1.049
1.08	0.160	-.080	0.894	-.069	0.149	0.420	1.069
1.10	0.160	-.080	0.894	-.065	0.151	0.396	1.088

DATA FOR INVERTER, CEA CONTROL
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.090	0.894	-.117	0.137	0.647	0.890
0.92	0.180	-.090	0.894	-.114	0.140	0.632	0.909
0.94	0.180	-.090	0.894	-.111	0.142	0.616	0.929
0.96	0.180	-.090	0.894	-.108	0.144	0.600	0.949
0.98	0.180	-.090	0.894	-.105	0.146	0.582	0.969
1.00	0.180	-.090	0.894	-.102	0.149	0.565	0.989
1.02	0.180	-.090	0.894	-.099	0.151	0.547	1.009
1.04	0.180	-.090	0.894	-.095	0.153	0.528	1.029
1.06	0.180	-.090	0.894	-.092	0.156	0.508	1.049
1.08	0.180	-.090	0.894	-.089	0.158	0.488	1.068
1.10	0.180	-.090	0.894	-.085	0.161	0.468	1.088

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.100	0.894	-.137	0.147	0.680	0.889
0.92	0.200	-.100	0.894	-.134	0.150	0.667	0.909
0.94	0.200	-.100	0.894	-.131	0.152	0.653	0.929
0.96	0.200	-.100	0.894	-.128	0.154	0.639	0.949
0.98	0.200	-.100	0.894	-.125	0.156	0.624	0.969
1.00	0.200	-.100	0.894	-.122	0.159	0.609	0.989
1.02	0.200	-.100	0.894	-.119	0.161	0.593	1.009
1.04	0.200	-.100	0.894	-.115	0.163	0.577	1.028
1.06	0.200	-.100	0.894	-.112	0.166	0.560	1.048
1.08	0.200	-.100	0.894	-.109	0.168	0.542	1.068
1.10	0.200	-.100	0.894	-.105	0.171	0.524	1.088

REALISTIC LOAD REPRESENTATION

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.010	0.894	0.049	0.062	0.621	0.891
0.92	0.020	-.010	0.894	0.051	0.063	0.627	0.911
0.94	0.020	-.010	0.894	0.053	0.065	0.633	0.931
0.96	0.020	-.010	0.894	0.055	0.066	0.639	0.951
0.98	0.020	-.010	0.894	0.057	0.068	0.644	0.971
1.00	0.020	-.010	0.894	0.059	0.069	0.649	0.991
1.02	0.020	-.010	0.894	0.061	0.071	0.653	1.011
1.04	0.020	-.010	0.894	0.063	0.072	0.658	1.031
1.06	0.020	-.010	0.894	0.065	0.074	0.662	1.051
1.08	0.020	-.010	0.894	0.067	0.076	0.666	1.070
1.10	0.020	-.010	0.894	0.070	0.077	0.669	1.090

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.020	0.894	0.029	0.072	0.373	0.891
0.92	0.040	-.020	0.894	0.031	0.073	0.389	0.911
0.94	0.040	-.020	0.894	0.033	0.075	0.403	0.931
0.96	0.040	-.020	0.894	0.035	0.076	0.417	0.951
0.98	0.040	-.020	0.894	0.037	0.078	0.429	0.971
1.00	0.040	-.020	0.894	0.039	0.079	0.442	0.990
1.02	0.040	-.020	0.894	0.041	0.081	0.453	1.010
1.04	0.040	-.020	0.894	0.043	0.082	0.464	1.030
1.06	0.040	-.020	0.894	0.045	0.084	0.475	1.050
1.08	0.040	-.020	0.894	0.047	0.086	0.485	1.070
1.10	0.040	-.020	0.894	0.050	0.087	0.494	1.090

TABLE B-XI, cont.

DATA FOR INVERTER, CEA CONTROL
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.030	0.894	0.009	0.082	0.107	0.890
0.92	0.060	-.030	0.894	0.011	0.083	0.129	0.910
0.94	0.060	-.030	0.894	0.013	0.085	0.150	0.930
0.96	0.060	-.030	0.894	0.015	0.086	0.170	0.950
0.98	0.060	-.030	0.894	0.017	0.088	0.190	0.970
1.00	0.060	-.030	0.894	0.019	0.089	0.208	0.990
1.02	0.060	-.030	0.894	0.021	0.091	0.226	1.010
1.04	0.060	-.030	0.894	0.023	0.092	0.243	1.030
1.06	0.060	-.030	0.894	0.025	0.094	0.260	1.050
1.08	0.060	-.030	0.894	0.027	0.096	0.275	1.070
1.10	0.060	-.030	0.894	0.029	0.097	0.291	1.090

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.040	0.894	-.011	0.092	0.122	0.890
0.92	0.080	-.040	0.894	-.009	0.093	0.098	0.910
0.94	0.080	-.040	0.894	-.007	0.095	0.076	0.930
0.96	0.080	-.040	0.894	-.005	0.096	0.053	0.950
0.98	0.080	-.040	0.894	-.003	0.098	0.032	0.970
1.00	0.080	-.040	0.894	-.001	0.099	0.010	0.990
1.02	0.080	-.040	0.894	0.001	0.101	0.010	1.010
1.04	0.080	-.040	0.894	0.003	0.102	0.031	1.030
1.06	0.080	-.040	0.894	0.005	0.104	0.050	1.050
1.08	0.080	-.040	0.894	0.007	0.106	0.069	1.070
1.10	0.080	-.040	0.894	0.009	0.107	0.088	1.090

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.050	0.894	-.031	0.102	0.294	0.890
0.92	0.100	-.050	0.894	-.029	0.103	0.273	0.910
0.94	0.100	-.050	0.894	-.027	0.105	0.252	0.930
0.96	0.100	-.050	0.894	-.025	0.106	0.231	0.950
0.98	0.100	-.050	0.894	-.023	0.108	0.210	0.970
1.00	0.100	-.050	0.894	-.021	0.109	0.189	0.990
1.02	0.100	-.050	0.894	-.019	0.111	0.169	1.010
1.04	0.100	-.050	0.894	-.017	0.112	0.149	1.030
1.06	0.100	-.050	0.894	-.015	0.114	0.129	1.050
1.08	0.100	-.050	0.894	-.013	0.115	0.109	1.070
1.10	0.100	-.050	0.894	-.011	0.117	0.090	1.090

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.060	0.894	-.051	0.112	0.418	0.890
0.92	0.120	-.060	0.894	-.049	0.113	0.399	0.910
0.94	0.120	-.060	0.894	-.047	0.115	0.381	0.930
0.96	0.120	-.060	0.894	-.045	0.116	0.363	0.950
0.98	0.120	-.060	0.894	-.043	0.118	0.344	0.970
1.00	0.120	-.060	0.894	-.041	0.119	0.326	0.990
1.02	0.120	-.060	0.894	-.039	0.121	0.307	1.010
1.04	0.120	-.060	0.894	-.037	0.122	0.289	1.030
1.06	0.120	-.060	0.894	-.035	0.124	0.271	1.050
1.08	0.120	-.060	0.894	-.033	0.125	0.252	1.069
1.10	0.120	-.060	0.894	-.031	0.127	0.234	1.089

DATA FOR INVERTER, CEA CONTROL
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.070	0.894	-.071	0.122	0.506	0.889
0.92	0.140	-.070	0.894	-.069	0.123	0.491	0.909
0.94	0.140	-.070	0.894	-.067	0.125	0.475	0.929
0.96	0.140	-.070	0.894	-.065	0.126	0.459	0.949
0.98	0.140	-.070	0.894	-.063	0.128	0.444	0.969
1.00	0.140	-.070	0.894	-.061	0.129	0.428	0.989
1.02	0.140	-.070	0.894	-.059	0.131	0.412	1.009
1.04	0.140	-.070	0.894	-.057	0.132	0.395	1.029
1.06	0.140	-.070	0.894	-.055	0.134	0.379	1.049
1.08	0.140	-.070	0.894	-.053	0.135	0.363	1.069
1.10	0.140	-.070	0.894	-.051	0.137	0.346	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.080	0.894	-.091	0.132	0.570	0.889
0.92	0.160	-.080	0.894	-.089	0.133	0.557	0.909
0.94	0.160	-.080	0.894	-.087	0.135	0.544	0.929
0.96	0.160	-.080	0.894	-.085	0.136	0.531	0.949
0.98	0.160	-.080	0.894	-.083	0.138	0.517	0.969
1.00	0.160	-.080	0.894	-.081	0.139	0.504	0.989
1.02	0.160	-.080	0.894	-.079	0.141	0.490	1.009
1.04	0.160	-.080	0.894	-.077	0.142	0.476	1.029
1.06	0.160	-.080	0.894	-.075	0.144	0.462	1.049
1.08	0.160	-.080	0.894	-.073	0.145	0.447	1.069
1.10	0.160	-.080	0.894	-.071	0.147	0.433	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.090	0.894	-.111	0.141	0.618	0.889
0.92	0.180	-.090	0.894	-.109	0.143	0.607	0.909
0.94	0.180	-.090	0.894	-.107	0.145	0.596	0.929
0.96	0.180	-.090	0.894	-.105	0.146	0.585	0.949
0.98	0.180	-.090	0.894	-.103	0.148	0.573	0.969
1.00	0.180	-.090	0.894	-.101	0.149	0.561	0.989
1.02	0.180	-.090	0.894	-.099	0.151	0.549	1.009
1.04	0.180	-.090	0.894	-.097	0.152	0.537	1.029
1.06	0.180	-.090	0.894	-.095	0.154	0.525	1.049
1.08	0.180	-.090	0.894	-.093	0.155	0.513	1.069
1.10	0.180	-.090	0.894	-.091	0.157	0.500	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.100	0.894	-.131	0.151	0.655	0.889
0.92	0.200	-.100	0.894	-.129	0.153	0.646	0.909
0.94	0.200	-.100	0.894	-.127	0.154	0.636	0.929
0.96	0.200	-.100	0.894	-.125	0.156	0.626	0.949
0.98	0.200	-.100	0.894	-.123	0.158	0.616	0.969
1.00	0.200	-.100	0.894	-.121	0.159	0.606	0.989
1.02	0.200	-.100	0.894	-.119	0.161	0.595	1.009
1.04	0.200	-.100	0.894	-.117	0.162	0.585	1.029
1.06	0.200	-.100	0.894	-.115	0.164	0.574	1.049
1.08	0.200	-.100	0.894	-.113	0.165	0.563	1.069
1.10	0.200	-.100	0.894	-.111	0.167	0.552	1.089

TABLE B-XII

DATA FOR INVERTER, CEA CONTROL

CONSTANT IMPEDANCE LOAD HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.010	0.894	0.522	0.416	0.782	0.823
0.92	0.020	-.010	0.894	0.546	0.435	0.782	0.841
0.94	0.020	-.010	0.894	0.571	0.453	0.783	0.860
0.96	0.020	-.010	0.894	0.597	0.472	0.784	0.878
0.98	0.020	-.010	0.894	0.623	0.492	0.785	0.896
1.00	0.020	-.010	0.894	0.649	0.512	0.785	0.914
1.02	0.020	-.010	0.894	0.676	0.532	0.786	0.933
1.04	0.020	-.010	0.894	0.704	0.553	0.786	0.951
1.06	0.020	-.010	0.894	0.732	0.574	0.787	0.969
1.08	0.020	-.010	0.894	0.760	0.595	0.787	0.988
1.10	0.020	-.010	0.894	0.790	0.617	0.788	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.020	0.894	0.502	0.426	0.762	0.823
0.92	0.040	-.020	0.894	0.526	0.445	0.764	0.841
0.94	0.040	-.020	0.894	0.551	0.463	0.765	0.860
0.96	0.040	-.020	0.894	0.576	0.482	0.767	0.878
0.98	0.040	-.020	0.894	0.602	0.502	0.768	0.896
1.00	0.040	-.020	0.894	0.629	0.522	0.770	0.914
1.02	0.040	-.020	0.894	0.656	0.542	0.771	0.933
1.04	0.040	-.020	0.894	0.684	0.563	0.772	0.951
1.06	0.040	-.020	0.894	0.712	0.584	0.773	0.969
1.08	0.040	-.020	0.894	0.740	0.605	0.774	0.988
1.10	0.040	-.020	0.894	0.769	0.627	0.775	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.030	0.894	0.482	0.436	0.741	0.823
0.92	0.060	-.030	0.894	0.506	0.454	0.744	0.841
0.94	0.060	-.030	0.894	0.531	0.473	0.747	0.859
0.96	0.060	-.030	0.894	0.556	0.492	0.749	0.878
0.98	0.060	-.030	0.894	0.582	0.512	0.751	0.896
1.00	0.060	-.030	0.894	0.609	0.532	0.753	0.914
1.02	0.060	-.030	0.894	0.636	0.552	0.755	0.933
1.04	0.060	-.030	0.894	0.663	0.573	0.757	0.951
1.06	0.060	-.030	0.894	0.691	0.594	0.759	0.969
1.08	0.060	-.030	0.894	0.720	0.615	0.760	0.987
1.10	0.060	-.030	0.894	0.749	0.637	0.762	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.040	0.894	0.461	0.446	0.719	0.823
0.92	0.080	-.040	0.894	0.486	0.464	0.723	0.841
0.94	0.080	-.040	0.894	0.511	0.483	0.727	0.859
0.96	0.080	-.040	0.894	0.536	0.502	0.730	0.878
0.98	0.080	-.040	0.894	0.562	0.522	0.733	0.896
1.00	0.080	-.040	0.894	0.589	0.541	0.736	0.914
1.02	0.080	-.040	0.894	0.616	0.562	0.739	0.933
1.04	0.080	-.040	0.894	0.643	0.582	0.741	0.951
1.06	0.080	-.040	0.894	0.671	0.603	0.744	0.969
1.08	0.080	-.040	0.894	0.700	0.625	0.746	0.987
1.10	0.080	-.040	0.894	0.729	0.647	0.748	1.006

DATA FOR INVERTER, CEA CONTROL
HEAVY LOAD CASE

ORIGINAL PAGE IS
OF POOR QUALITY

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.050	0.894	0.441	0.456	0.695	0.822
0.92	0.100	-.050	0.894	0.466	0.474	0.701	0.841
0.94	0.100	-.050	0.894	0.491	0.493	0.705	0.859
0.96	0.100	-.050	0.894	0.516	0.512	0.710	0.877
0.98	0.100	-.050	0.894	0.542	0.531	0.714	0.896
1.00	0.100	-.050	0.894	0.568	0.551	0.718	0.914
1.02	0.100	-.050	0.894	0.596	0.572	0.721	0.932
1.04	0.100	-.050	0.894	0.623	0.592	0.725	0.951
1.06	0.100	-.050	0.894	0.651	0.613	0.728	0.969
1.08	0.100	-.050	0.894	0.680	0.635	0.731	0.987
1.10	0.100	-.050	0.894	0.709	0.657	0.734	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.060	0.894	0.421	0.466	0.671	0.822
0.92	0.120	-.060	0.894	0.445	0.484	0.677	0.841
0.94	0.120	-.060	0.894	0.470	0.503	0.683	0.859
0.96	0.120	-.060	0.894	0.496	0.522	0.689	0.877
0.98	0.120	-.060	0.894	0.522	0.541	0.694	0.896
1.00	0.120	-.060	0.894	0.548	0.561	0.699	0.914
1.02	0.120	-.060	0.894	0.575	0.582	0.703	0.932
1.04	0.120	-.060	0.894	0.603	0.602	0.708	0.951
1.06	0.120	-.060	0.894	0.631	0.623	0.711	0.969
1.08	0.120	-.060	0.894	0.660	0.645	0.715	0.987
1.10	0.120	-.060	0.894	0.689	0.667	0.719	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.070	0.894	0.401	0.476	0.644	0.822
0.92	0.140	-.070	0.894	0.425	0.494	0.652	0.841
0.94	0.140	-.070	0.894	0.450	0.513	0.660	0.859
0.96	0.140	-.070	0.894	0.476	0.532	0.667	0.877
0.98	0.140	-.070	0.894	0.502	0.551	0.673	0.896
1.00	0.140	-.070	0.894	0.528	0.571	0.679	0.914
1.02	0.140	-.070	0.894	0.555	0.591	0.684	0.932
1.04	0.140	-.070	0.894	0.583	0.612	0.690	0.950
1.06	0.140	-.070	0.894	0.611	0.633	0.694	0.969
1.08	0.140	-.070	0.894	0.640	0.655	0.699	0.987
1.10	0.140	-.070	0.894	0.669	0.677	0.703	1.005

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.080	0.894	0.381	0.485	0.617	0.822
0.92	0.160	-.080	0.894	0.405	0.504	0.627	0.840
0.94	0.160	-.080	0.894	0.430	0.523	0.635	0.859
0.96	0.160	-.080	0.894	0.455	0.542	0.644	0.877
0.98	0.160	-.080	0.894	0.481	0.561	0.651	0.895
1.00	0.160	-.080	0.894	0.508	0.581	0.658	0.914
1.02	0.160	-.080	0.894	0.535	0.601	0.665	0.932
1.04	0.160	-.080	0.894	0.563	0.622	0.671	0.950
1.06	0.160	-.080	0.894	0.591	0.643	0.677	0.969
1.08	0.160	-.080	0.894	0.619	0.664	0.682	0.987
1.10	0.160	-.080	0.894	0.649	0.686	0.687	1.005

DATA FOR INVERTER, CEA CONTROL
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.090	0.894	0.360	0.495	0.588	0.822
0.92	0.180	-.090	0.894	0.385	0.514	0.600	0.840
0.94	0.180	-.090	0.894	0.410	0.532	0.610	0.859
0.96	0.180	-.090	0.894	0.435	0.551	0.620	0.877
0.98	0.180	-.090	0.894	0.461	0.571	0.628	0.895
1.00	0.180	-.090	0.894	0.488	0.591	0.637	0.914
1.02	0.180	-.090	0.894	0.515	0.611	0.644	0.932
1.04	0.180	-.090	0.894	0.542	0.632	0.651	0.950
1.06	0.180	-.090	0.894	0.570	0.653	0.658	0.969
1.08	0.180	-.090	0.894	0.599	0.674	0.664	0.987
1.10	0.180	-.090	0.894	0.628	0.696	0.670	1.005

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.100	0.894	0.340	0.505	0.559	0.822
0.92	0.200	-.100	0.894	0.365	0.524	0.572	0.840
0.94	0.200	-.100	0.894	0.390	0.542	0.584	0.858
0.96	0.200	-.100	0.894	0.415	0.561	0.595	0.877
0.98	0.200	-.100	0.894	0.441	0.581	0.605	0.895
1.00	0.200	-.100	0.894	0.468	0.601	0.614	0.913
1.02	0.200	-.100	0.894	0.495	0.621	0.623	0.932
1.04	0.200	-.100	0.894	0.522	0.642	0.631	0.950
1.06	0.200	-.100	0.894	0.550	0.663	0.639	0.968
1.08	0.200	-.100	0.894	0.579	0.684	0.646	0.987
1.10	0.200	-.100	0.894	0.608	0.706	0.653	1.005

REALISTIC LOAD REPRESENTATION

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.010	0.894	0.590	0.468	0.784	0.812
0.92	0.020	-.010	0.894	0.609	0.482	0.784	0.831
0.94	0.020	-.010	0.894	0.628	0.496	0.785	0.851
0.96	0.020	-.010	0.894	0.648	0.511	0.785	0.870
0.98	0.020	-.010	0.894	0.667	0.525	0.786	0.890
1.00	0.020	-.010	0.894	0.687	0.540	0.786	0.909
1.02	0.020	-.010	0.894	0.706	0.555	0.786	0.928
1.04	0.020	-.010	0.894	0.726	0.570	0.787	0.948
1.06	0.020	-.010	0.894	0.746	0.585	0.787	0.967
1.08	0.020	-.010	0.894	0.766	0.600	0.787	0.987
1.10	0.020	-.010	0.894	0.787	0.615	0.788	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.020	0.894	0.570	0.478	0.767	0.812
0.92	0.040	-.020	0.894	0.589	0.492	0.768	0.831
0.94	0.040	-.020	0.894	0.608	0.506	0.769	0.851
0.96	0.040	-.020	0.894	0.628	0.521	0.770	0.870
0.98	0.040	-.020	0.894	0.647	0.535	0.771	0.889
1.00	0.040	-.020	0.894	0.667	0.550	0.771	0.909
1.02	0.040	-.020	0.894	0.686	0.565	0.772	0.928
1.04	0.040	-.020	0.894	0.706	0.580	0.773	0.948
1.06	0.040	-.020	0.894	0.726	0.595	0.774	0.967
1.08	0.040	-.020	0.894	0.746	0.610	0.774	0.987
1.10	0.040	-.020	0.894	0.766	0.625	0.775	1.006

TABLE B-XII, cont.

DATA FOR INVERTER, CEA CONTROL
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.030	0.894	0.550	0.488	0.748	0.812
0.92	0.060	-.030	0.894	0.569	0.502	0.750	0.831
0.94	0.060	-.030	0.894	0.588	0.516	0.752	0.851
0.96	0.060	-.030	0.894	0.608	0.531	0.753	0.870
0.98	0.060	-.030	0.894	0.627	0.545	0.755	0.889
1.00	0.060	-.030	0.894	0.647	0.560	0.756	0.909
1.02	0.060	-.030	0.894	0.666	0.575	0.757	0.928
1.04	0.060	-.030	0.894	0.686	0.590	0.758	0.948
1.06	0.060	-.030	0.894	0.706	0.605	0.760	0.967
1.08	0.060	-.030	0.894	0.726	0.620	0.761	0.987
1.10	0.060	-.030	0.894	0.746	0.635	0.762	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.040	0.894	0.530	0.498	0.729	0.812
0.92	0.080	-.040	0.894	0.549	0.512	0.731	0.831
0.94	0.080	-.040	0.894	0.568	0.526	0.734	0.850
0.96	0.080	-.040	0.894	0.587	0.541	0.736	0.870
0.98	0.080	-.040	0.894	0.607	0.555	0.738	0.889
1.00	0.080	-.040	0.894	0.626	0.570	0.740	0.909
1.02	0.080	-.040	0.894	0.646	0.585	0.742	0.928
1.04	0.080	-.040	0.894	0.666	0.599	0.743	0.948
1.06	0.080	-.040	0.894	0.686	0.614	0.745	0.967
1.08	0.080	-.040	0.894	0.706	0.630	0.746	0.987
1.10	0.080	-.040	0.894	0.726	0.645	0.748	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.050	0.894	0.510	0.507	0.709	0.812
0.92	0.100	-.050	0.894	0.529	0.522	0.712	0.831
0.94	0.100	-.050	0.894	0.548	0.536	0.715	0.850
0.96	0.100	-.050	0.894	0.567	0.550	0.718	0.870
0.98	0.100	-.050	0.894	0.587	0.565	0.720	0.889
1.00	0.100	-.050	0.894	0.606	0.580	0.723	0.909
1.02	0.100	-.050	0.894	0.626	0.595	0.725	0.928
1.04	0.100	-.050	0.894	0.646	0.609	0.727	0.948
1.06	0.100	-.050	0.894	0.666	0.624	0.729	0.967
1.08	0.100	-.050	0.894	0.686	0.639	0.731	0.986
1.10	0.100	-.050	0.894	0.706	0.655	0.733	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.060	0.894	0.490	0.517	0.688	0.812
0.92	0.120	-.060	0.894	0.509	0.532	0.691	0.831
0.94	0.120	-.060	0.894	0.528	0.546	0.695	0.850
0.96	0.120	-.060	0.894	0.547	0.560	0.699	0.870
0.98	0.120	-.060	0.894	0.567	0.575	0.702	0.889
1.00	0.120	-.060	0.894	0.586	0.590	0.705	0.909
1.02	0.120	-.060	0.894	0.606	0.604	0.708	0.928
1.04	0.120	-.060	0.894	0.626	0.619	0.711	0.947
1.06	0.120	-.060	0.894	0.646	0.634	0.713	0.967
1.08	0.120	-.060	0.894	0.666	0.649	0.716	0.986
1.10	0.120	-.060	0.894	0.686	0.665	0.718	1.006

TABLE B-XII, cont.

DATA FOR INVERTER, CEA CONTROL
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.070	0.894	0.470	0.527	0.665	0.811
0.92	0.140	-.070	0.894	0.489	0.541	0.670	0.831
0.94	0.140	-.070	0.894	0.508	0.556	0.674	0.850
0.96	0.140	-.070	0.894	0.527	0.570	0.679	0.870
0.98	0.140	-.070	0.894	0.547	0.585	0.683	0.889
1.00	0.140	-.070	0.894	0.566	0.600	0.687	0.908
1.02	0.140	-.070	0.894	0.586	0.614	0.690	0.928
1.04	0.140	-.070	0.894	0.606	0.629	0.693	0.947
1.06	0.140	-.070	0.894	0.626	0.644	0.697	0.967
1.08	0.140	-.070	0.894	0.646	0.659	0.700	0.986
1.10	0.140	-.070	0.894	0.666	0.674	0.703	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.080	0.894	0.450	0.537	0.642	0.811
0.92	0.160	-.080	0.894	0.468	0.551	0.647	0.831
0.94	0.160	-.080	0.894	0.488	0.566	0.653	0.850
0.96	0.160	-.080	0.894	0.507	0.580	0.658	0.869
0.98	0.160	-.080	0.894	0.526	0.595	0.663	0.889
1.00	0.160	-.080	0.894	0.546	0.609	0.667	0.908
1.02	0.160	-.080	0.894	0.566	0.624	0.671	0.928
1.04	0.160	-.080	0.894	0.586	0.639	0.676	0.947
1.06	0.160	-.080	0.894	0.606	0.654	0.679	0.967
1.08	0.160	-.080	0.894	0.626	0.669	0.683	0.986
1.10	0.160	-.080	0.894	0.646	0.684	0.686	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.090	0.894	0.429	0.547	0.617	0.811
0.92	0.180	-.090	0.894	0.448	0.561	0.624	0.830
0.94	0.180	-.090	0.894	0.467	0.576	0.630	0.850
0.96	0.180	-.090	0.894	0.487	0.590	0.636	0.869
0.98	0.180	-.090	0.894	0.506	0.605	0.642	0.889
1.00	0.180	-.090	0.894	0.5[illegible]6	0.619	0.647	0.908
1.02	0.180	-.090	0.894	0.546	0.634	0.652	0.928
1.04	0.180	-.090	0.894	0.565	0.649	0.657	0.947
1.06	0.180	-.090	0.894	0.585	0.664	0.661	0.967
1.08	0.180	-.090	0.894	0.605	0.679	0.665	0.986
1.10	0.180	-.090	0.894	0.626	0.694	0.669	1.005

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.100	0.894	0.409	0.557	0.592	0.811
0.92	0.200	-.100	0.894	0.428	0.571	0.600	0.830
0.94	0.200	-.100	0.894	0.447	0.585	0.607	0.850
0.96	0.200	-.100	0.894	0.467	0.600	0.614	0.869
0.98	0.200	-.100	0.894	0.486	0.615	0.620	0.889
1.00	0.200	-.100	0.894	0.506	0.629	0.626	0.908
1.02	0.200	-.100	0.894	0.525	0.644	0.632	0.927
1.04	0.200	-.100	0.894	0.545	0.659	0.638	0.947
1.06	0.200	-.100	0.894	0.565	0.674	0.643	0.966
1.08	0.200	-.100	0.894	0.585	0.689	0.647	0.986
1.10	0.200	-.100	0.894	0.606	0.704	0.652	1.005

TABLE B-XIII

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DATA FOR INVERTER, CEA - COMPENSATED
LIGHT LOAD CASE

CONSTANT IMPEDANCE LOAD

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	0.071	0.271	0.045	-.022	0.894	0.900
0.92	0.020	0.075	0.259	0.048	-.024	0.894	0.920
0.94	0.020	0.078	0.247	0.051	-.025	0.894	0.941
0.96	0.020	0.082	0.236	0.054	-.027	0.894	0.961
0.98	0.020	0.086	0.226	0.057	-.028	0.894	0.981
1.00	0.020	0.090	0.217	0.060	-.030	0.894	1.001
1.02	0.020	0.094	0.208	0.063	-.032	0.894	1.021
1.04	0.020	0.098	0.199	0.067	-.033	0.894	1.041
1.06	0.020	0.102	0.192	0.070	-.035	0.894	1.061
1.08	0.020	0.107	0.184	0.073	-.037	0.894	1.081
1.10	0.020	0.111	0.177	0.077	-.038	0.894	1.101
SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	0.061	0.548	0.025	-.012	0.894	0.900
0.92	0.040	0.065	0.526	0.028	-.014	0.894	0.920
0.94	0.040	0.068	0.505	0.031	-.015	0.894	0.940
0.96	0.040	0.072	0.484	0.034	-.017	0.894	0.960
0.98	0.040	0.076	0.465	0.037	-.018	0.894	0.980
1.00	0.040	0.080	0.447	0.040	-.020	0.894	1.000
1.02	0.040	0.084	0.429	0.043	-.022	0.894	1.020
1.04	0.040	0.088	0.413	0.047	-.023	0.894	1.040
1.06	0.040	0.092	0.397	0.050	-.025	0.894	1.060
1.08	0.040	0.097	0.382	0.053	-.027	0.894	1.080
1.10	0.040	0.101	0.368	0.057	-.028	0.894	1.100
SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	0.051	0.762	0.005	-.002	0.894	0.900
0.92	0.060	0.055	0.739	0.008	-.004	0.894	0.920
0.94	0.060	0.058	0.717	0.011	-.005	0.894	0.940
0.96	0.060	0.062	0.694	0.014	-.007	0.894	0.960
0.98	0.060	0.066	0.672	0.017	-.008	0.894	0.980
1.00	0.060	0.070	0.651	0.020	-.010	0.894	1.000
1.02	0.060	0.074	0.629	0.023	-.012	0.894	1.020
1.04	0.060	0.078	0.609	0.027	-.013	0.894	1.040
1.06	0.060	0.082	0.589	0.030	-.015	0.894	1.060
1.08	0.060	0.087	0.569	0.033	-.017	0.894	1.080
1.10	0.060	0.091	0.550	0.037	-.018	0.894	1.100
SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	0.041	0.890	-.015	0.008	0.894	0.900
0.92	0.080	0.045	0.873	-.012	0.006	0.894	0.920
0.94	0.080	0.048	0.856	-.009	0.005	0.894	0.940
0.96	0.080	0.052	0.838	-.006	0.003	0.894	0.960
0.98	0.080	0.056	0.819	-.003	0.002	0.894	0.980
1.00	0.080	0.060	0.800	-.000	0.000	0.936	1.000
1.02	0.080	0.064	0.781	0.003	-.002	0.894	1.020
1.04	0.080	0.068	0.761	0.007	-.003	0.894	1.040
1.06	0.080	0.072	0.742	0.010	-.005	0.894	1.060
1.08	0.080	0.077	0.722	0.013	-.007	0.894	1.080
1.10	0.080	0.081	0.703	0.017	-.008	0.894	1.100

DATA FOR INVERTER, CEA - COMPENSATED
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	0.031	0.955	-.035	0.018	0.894	0.900
0.92	0.100	0.035	0.945	-.032	0.016	0.894	0.920
0.94	0.100	0.038	0.934	-.029	0.015	0.894	0.940
0.96	0.100	0.042	0.922	-.026	0.013	0.894	0.960
0.98	0.100	0.046	0.909	-.023	0.012	0.894	0.980
1.00	0.100	0.050	0.895	-.020	0.010	0.894	1.000
1.02	0.100	0.054	0.880	-.017	0.008	0.894	1.020
1.04	0.100	0.058	0.865	-.013	0.007	0.894	1.040
1.06	0.100	0.062	0.849	-.010	0.005	0.894	1.060
1.08	0.100	0.067	0.832	-.007	0.003	0.894	1.080
1.10	0.100	0.071	0.815	-.003	0.002	0.894	1.100

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	0.021	0.985	-.055	0.028	0.894	0.899
0.92	0.120	0.025	0.980	-.052	0.026	0.894	0.919
0.94	0.120	0.028	0.973	-.049	0.025	0.894	0.939
0.96	0.120	0.032	0.966	-.046	0.023	0.894	0.959
0.98	0.120	0.036	0.958	-.043	0.022	0.894	0.980
1.00	0.120	0.040	0.949	-.040	0.020	0.894	1.000
1.02	0.120	0.044	0.939	-.037	0.018	0.894	1.020
1.04	0.120	0.048	0.928	-.034	0.017	0.894	1.040
1.06	0.120	0.052	0.917	-.030	0.015	0.894	1.060
1.08	0.120	0.057	0.904	-.027	0.013	0.894	1.080
1.10	0.120	0.061	0.892	-.023	0.012	0.894	1.100

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	0.011	0.997	-.075	0.038	0.894	0.899
0.92	0.140	0.014	0.995	-.072	0.036	0.894	0.919
0.94	0.140	0.018	0.992	-.069	0.035	0.894	0.939
0.96	0.140	0.022	0.988	-.066	0.033	0.894	0.959
0.98	0.140	0.026	0.983	-.063	0.032	0.894	0.979
1.00	0.140	0.030	0.978	-.060	0.030	0.894	0.999
1.02	0.140	0.034	0.972	-.057	0.028	0.894	1.019
1.04	0.140	0.038	0.965	-.054	0.027	0.894	1.039
1.06	0.140	0.042	0.957	-.050	0.025	0.894	1.060
1.08	0.140	0.047	0.949	-.047	0.023	0.894	1.080
1.10	0.140	0.051	0.940	-.043	0.022	0.894	1.100

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	0.001	1.000	-.095	0.048	0.894	0.899
0.92	0.160	0.004	1.000	-.092	0.046	0.894	0.919
0.94	0.160	0.008	0.999	-.089	0.045	0.894	0.939
0.96	0.160	0.012	0.997	-.086	0.043	0.894	0.959
0.98	0.160	0.016	0.995	-.083	0.042	0.894	0.979
1.00	0.160	0.020	0.992	-.080	0.040	0.894	0.999
1.02	0.160	0.024	0.989	-.077	0.038	0.894	1.019
1.04	0.160	0.028	0.985	-.074	0.037	0.894	1.039
1.06	0.160	0.032	0.980	-.070	0.035	0.894	1.059
1.08	0.160	0.037	0.975	-.067	0.033	0.894	1.079
1.10	0.160	0.041	0.969	-.063	0.032	0.894	1.099

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DATA FOR INVERTER, CEA - COMPENSATED
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.009	0.999	-.115	0.058	0.894	0.899
0.92	0.180	-.006	1.000	-.112	0.056	0.894	0.919
0.94	0.180	-.002	1.000	-.110	0.055	0.894	0.939
0.96	0.180	0.002	1.000	-.106	0.053	0.894	0.959
0.98	0.180	0.006	0.999	-.103	0.052	0.894	0.979
1.00	0.180	0.010	0.999	-.100	0.050	0.894	0.999
1.02	0.180	0.014	0.997	-.097	0.048	0.894	1.019
1.04	0.180	0.018	0.995	-.094	0.047	0.894	1.039
1.06	0.180	0.022	0.993	-.090	0.045	0.894	1.059
1.08	0.180	0.026	0.989	-.087	0.043	0.894	1.079
1.10	0.180	0.031	0.986	-.083	0.042	0.894	1.099

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.019	0.995	-.135	0.068	0.894	0.898
0.92	0.200	-.016	0.997	-.133	0.066	0.894	0.918
0.94	0.200	-.012	0.998	-.130	0.065	0.894	0.938
0.96	0.200	-.008	0.999	-.126	0.063	0.894	0.959
0.98	0.200	-.004	1.000	-.123	0.062	0.894	0.979
1.00	0.200	-.000	1.000	-.120	0.060	0.894	0.999
1.02	0.200	0.004	1.000	-.117	0.058	0.894	1.019
1.04	0.200	0.008	0.999	-.114	0.057	0.894	1.039
1.06	0.200	0.012	0.998	-.110	0.055	0.894	1.059
1.08	0.200	0.016	0.997	-.107	0.053	0.894	1.079
1.10	0.200	0.021	0.995	-.103	0.052	0.894	1.099

REALISTIC LOAD REPRESENTATION   LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	0.071	0.271	0.050	-.019	0.936	0.900
0.92	0.020	0.075	0.259	0.052	-.021	0.928	0.920
0.94	0.020	0.078	0.247	0.054	-.023	0.920	0.940
0.96	0.020	0.082	0.236	0.056	-.025	0.911	0.960
0.98	0.020	0.086	0.226	0.058	-.028	0.903	0.980
1.00	0.020	0.090	0.217	0.060	-.030	0.894	1.001
1.02	0.020	0.094	0.208	0.062	-.033	0.886	1.021
1.04	0.020	0.098	0.199	0.064	-.035	0.877	1.041
1.06	0.020	0.103	0.191	0.066	-.038	0.869	1.061
1.08	0.020	0.107	0.184	0.069	-.040	0.861	1.081
1.10	0.020	0.111	0.177	0.071	-.043	0.853	1.101

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	0.061	0.549	0.030	-.009	0.960	0.900
0.92	0.040	0.065	0.526	0.032	-.011	0.947	0.920
0.94	0.040	0.068	0.505	0.034	-.013	0.933	0.940
0.96	0.040	0.072	0.485	0.036	-.015	0.920	0.960
0.98	0.040	0.076	0.465	0.038	-.018	0.907	0.980
1.00	0.040	0.080	0.447	0.040	-.020	0.894	1.000
1.02	0.040	0.084	0.429	0.042	-.023	0.882	1.021
1.04	0.040	0.088	0.413	0.044	-.025	0.870	1.041
1.06	0.040	0.093	0.397	0.046	-.028	0.858	1.061
1.08	0.040	0.097	0.382	0.049	-.030	0.847	1.081
1.10	0.040	0.101	0.367	0.051	-.033	0.836	1.101

TABLE B-XIII, cont.

DATA FOR INVERTER, CEA - COMPENSATED
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	0.051	0.763	0.010	0.001	0.990	0.899
0.92	0.060	0.055	0.740	0.012	-.001	0.998	0.920
0.94	0.060	0.058	0.717	0.014	-.003	0.978	0.940
0.96	0.060	0.062	0.695	0.016	-.005	0.949	0.960
0.98	0.060	0.066	0.672	0.018	-.008	0.921	0.980
1.00	0.060	0.070	0.651	0.020	-.010	0.894	1.000
1.02	0.060	0.074	0.629	0.022	-.013	0.870	1.020
1.04	0.060	0.078	0.608	0.024	-.015	0.849	1.041
1.06	0.060	0.083	0.588	0.026	-.018	0.830	1.061
1.08	0.060	0.087	0.569	0.029	-.020	0.813	1.081
1.10	0.060	0.091	0.550	0.031	-.023	0.797	1.101

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	0.041	0.891	-.010	0.011	0.671	0.899
0.92	0.080	0.045	0.874	-.008	0.009	0.666	0.919
0.94	0.080	0.048	0.856	-.006	0.007	0.662	0.940
0.96	0.080	0.052	0.838	-.004	0.005	0.658	0.960
0.98	0.080	0.056	0.819	-.002	0.002	0.653	0.980
1.00	0.080	0.060	0.800	-.000	0.000	0.555	1.000
1.02	0.080	0.064	0.781	0.002	-.002	0.644	1.020
1.04	0.080	0.068	0.761	0.004	-.005	0.640	1.040
1.06	0.080	0.072	0.741	0.006	-.008	0.636	1.060
1.08	0.080	0.077	0.721	0.008	-.010	0.632	1.081
1.10	0.080	0.081	0.702	0.011	-.013	0.628	1.101

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	0.031	0.956	-.030	0.021	0.817	0.899
0.92	0.100	0.034	0.945	-.028	0.019	0.826	0.919
0.94	0.100	0.038	0.934	-.026	0.017	0.838	0.939
0.96	0.100	0.042	0.922	-.024	0.015	0.853	0.959
0.98	0.100	0.046	0.909	-.022	0.012	0.871	0.980
1.00	0.100	0.050	0.895	-.020	0.010	0.894	1.000
1.02	0.100	0.054	0.880	-.018	0.008	0.922	1.020
1.04	0.100	0.058	0.864	-.016	0.005	0.954	1.040
1.06	0.100	0.062	0.848	-.014	0.002	0.986	1.060
1.08	0.100	0.067	0.832	-.012	-.000	0.999	1.080
1.10	0.100	0.071	0.815	-.009	-.003	0.947	1.101

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	0.021	0.985	-.050	0.031	0.848	0.899
0.92	0.120	0.024	0.980	-.048	0.029	0.855	0.919
0.94	0.120	0.028	0.974	-.046	0.027	0.863	0.939
0.96	0.120	0.032	0.966	-.044	0.025	0.872	0.959
0.98	0.120	0.036	0.958	-.042	0.022	0.882	0.979
1.00	0.120	0.040	0.949	-.040	0.020	0.894	1.000
1.02	0.120	0.044	0.939	-.038	0.018	0.908	1.020
1.04	0.120	0.048	0.928	-.036	0.015	0.923	1.040
1.06	0.120	0.052	0.916	-.034	0.012	0.939	1.060
1.08	0.120	0.057	0.904	-.032	0.010	0.956	1.080
1.10	0.120	0.061	0.891	-.029	0.007	0.974	1.100

TABLE B-XIII, cont.

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR INVERTER, CEA - COMPENSATED
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	0.011	0.997	-.070	0.041	0.862	0.898
0.92	0.140	0.014	0.995	-.068	0.039	0.867	0.919
0.94	0.140	0.018	0.992	-.066	0.037	0.872	0.939
0.96	0.140	0.022	0.988	-.064	0.035	0.879	0.959
0.98	0.140	0.026	0.983	-.062	0.033	0.886	0.979
1.00	0.140	0.030	0.978	-.060	0.030	0.894	0.999
1.02	0.140	0.034	0.972	-.058	0.028	0.903	1.020
1.04	0.140	0.038	0.965	-.056	0.025	0.913	1.040
1.06	0.140	0.042	0.957	-.054	0.022	0.923	1.060
1.08	0.140	0.047	0.949	-.052	0.020	0.934	1.030
1.10	0.140	0.051	0.939	-.049	0.017	0.946	1.100

SYS V.	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	0.001	1.000	-.090	0.052	0.869	0.898
0.92	0.160	0.004	1.000	-.088	0.049	0.873	0.918
0.94	0.160	0.008	0.999	-.086	0.047	0.878	0.939
0.96	0.160	0.012	0.997	-.084	0.045	0.883	0.959
0.98	0.160	0.016	0.995	-.082	0.043	0.888	0.979
1.00	0.160	0.020	0.992	-.080	0.040	0.894	0.999
1.02	0.160	0.024	0.989	-.078	0.038	0.901	1.019
1.04	0.160	0.028	0.985	-.076	0.035	0.908	1.040
1.06	0.160	0.032	0.980	-.074	0.032	0.916	1.060
1.08	0.160	0.037	0.975	-.072	0.030	0.924	1.080
1.10	0.160	0.041	0.769	-.069	0.027	0.932	1.100

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.009	0.999	-.110	0.062	0.874	0.898
0.92	0.180	-.006	0.999	-.108	0.059	0.877	0.918
0.94	0.180	-.002	1.000	-.106	0.057	0.881	0.938
0.96	0.180	0.002	1.000	-.104	0.055	0.885	0.959
0.98	0.180	0.006	0.999	-.102	0.053	0.889	0.979
1.00	0.180	0.010	0.999	-.100	0.050	0.894	0.999
1.02	0.180	0.014	0.997	-.098	0.048	0.899	1.019
1.04	0.180	0.018	0.995	-.096	0.045	0.905	1.039
1.06	0.180	0.022	0.992	-.094	0.042	0.911	1.059
1.08	0.180	0.027	0.989	-.092	0.040	0.717	1.080
1.10	0.180	0.031	0.986	-.089	0.037	0.924	1.100

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.019	0.995	-.130	0.072	0.877	0.898
0.92	0.200	-.016	0.997	-.128	0.069	0.880	0.918
0.94	0.200	-.012	0.998	-.126	0.067	0.883	0.938
0.96	0.200	-.008	0.999	-.124	0.065	0.886	0.958
0.98	0.200	-.004	1.000	-.122	0.063	0.890	0.978
1.00	0.200	-.000	1.000	-.120	0.060	0.894	0.999
1.02	0.200	0.004	1.000	-.118	0.058	0.899	1.019
1.04	0.200	0.008	0.999	-.116	0.055	0.903	1.039
1.06	0.200	0.012	0.998	-.114	0.052	0.908	1.059
1.08	0.200	0.017	0.997	-.112	0.050	0.913	1.079
1.10	0.200	0.021	0.995	-.109	0.047	0.919	1.100

TABLE B-XIV

ORIGINAL PAGE IS OF POOR QUALITY

DATA FOR INVERTER, CEA - COMPENSATED

CONSTANT IMPEDANCE LOAD HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	0.059	0.321	0.532	0.355	0.832	0.830
0.92	0.020	0.062	0.307	0.556	0.370	0.833	0.849
0.94	0.020	0.065	0.293	0.582	0.386	0.833	0.867
0.96	0.020	0.068	0.280	0.608	0.402	0.834	0.886
0.98	0.020	0.072	0.268	0.634	0.419	0.834	0.904
1.00	0.020	0.075	0.257	0.661	0.436	0.835	0.923
1.02	0.020	0.079	0.247	0.689	0.453	0.836	0.941
1.04	0.020	0.082	0.237	0.717	0.470	0.836	0.960
1.06	0.020	0.086	0.227	0.745	0.488	0.836	0.978
1.08	0.020	0.089	0.219	0.774	0.507	0.837	0.997
1.10	0.020	0.093	0.210	0.804	0.525	0.837	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	0.049	0.633	0.512	0.365	0.814	0.830
0.92	0.040	0.052	0.609	0.536	0.380	0.816	0.849
0.94	0.040	0.055	0.587	0.562	0.396	0.817	0.867
0.96	0.040	0.058	0.565	0.588	0.412	0.819	0.886
0.98	0.040	0.062	0.544	0.614	0.429	0.820	0.904
1.00	0.040	0.065	0.523	0.641	0.446	0.821	0.923
1.02	0.040	0.069	0.504	0.669	0.463	0.822	0.941
1.04	0.040	0.072	0.485	0.697	0.480	0.823	0.960
1.06	0.040	0.076	0.467	0.725	0.498	0.824	0.978
1.08	0.040	0.079	0.450	0.754	0.516	0.825	0.996
1.10	0.040	0.083	0.434	0.784	0.535	0.826	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	0.039	0.839	0.491	0.375	0.795	0.830
0.92	0.060	0.042	0.819	0.516	0.390	0.798	0.849
0.94	0.060	0.045	0.799	0.542	0.406	0.800	0.867
0.96	0.060	0.048	0.778	0.567	0.422	0.802	0.886
0.98	0.060	0.052	0.757	0.594	0.439	0.804	0.904
1.00	0.060	0.055	0.736	0.621	0.456	0.806	0.923
1.02	0.060	0.059	0.716	0.648	0.473	0.808	0.941
1.04	0.060	0.062	0.695	0.676	0.490	0.810	0.959
1.06	0.060	0.066	0.675	0.705	0.508	0.811	0.978
1.08	0.060	0.069	0.655	0.734	0.526	0.813	0.996
1.10	0.060	0.073	0.635	0.764	0.545	0.814	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	0.029	0.940	0.471	0.385	0.775	0.830
0.92	0.080	0.032	0.928	0.496	0.400	0.778	0.849
0.94	0.080	0.035	0.915	0.521	0.416	0.782	0.867
0.96	0.080	0.038	0.901	0.547	0.432	0.785	0.886
0.98	0.080	0.042	0.887	0.574	0.449	0.788	0.904
1.00	0.080	0.045	0.871	0.601	0.465	0.790	0.922
1.02	0.080	0.049	0.855	0.628	0.483	0.793	0.941
1.04	0.080	0.052	0.838	0.656	0.500	0.795	0.959
1.06	0.080	0.056	0.821	0.685	0.518	0.798	0.978
1.08	0.080	0.059	0.804	0.714	0.536	0.800	0.996
1.10	0.080	0.063	0.786	0.744	0.555	0.802	1.015

TABLE B-XIV, cont.

DATA FOR INVERTER, CEA - COMPENSATED
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	0.019	0.983	0.451	0.394	0.753	0.830
0.92	0.100	0.022	0.977	0.476	0.410	0.758	0.849
0.94	0.100	0.025	0.970	0.501	0.426	0.762	0.867
0.96	0.100	0.028	0.962	0.527	0.442	0.766	0.885
0.98	0.100	0.032	0.953	0.554	0.459	0.770	0.904
1.00	0.100	0.035	0.944	0.581	0.475	0.774	0.922
1.02	0.100	0.039	0.933	0.608	0.493	0.777	0.941
1.04	0.100	0.042	0.922	0.636	0.510	0.780	0.959
1.06	0.100	0.046	0.910	0.665	0.528	0.783	0.978
1.08	0.100	0.049	0.897	0.694	0.546	0.786	0.996
1.10	0.100	0.053	0.884	0.724	0.565	0.788	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	0.009	0.997	0.431	0.404	0.729	0.830
0.92	0.120	0.012	0.995	0.456	0.420	0.736	0.848
0.94	0.120	0.015	0.992	0.481	0.436	0.741	0.867
0.96	0.120	0.018	0.988	0.507	0.452	0.747	0.885
0.98	0.120	0.022	0.984	0.533	0.468	0.751	0.904
1.00	0.120	0.025	0.979	0.560	0.485	0.756	0.922
1.02	0.120	0.029	0.973	0.588	0.503	0.760	0.941
1.04	0.120	0.032	0.966	0.616	0.520	0.764	0.959
1.06	0.120	0.036	0.959	0.645	0.538	0.768	0.978
1.08	0.120	0.039	0.950	0.674	0.556	0.771	0.996
1.10	0.120	0.043	0.942	0.704	0.575	0.774	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.001	1.000	0.411	0.414	0.704	0.830
0.92	0.140	0.002	1.000	0.436	0.430	0.712	0.848
0.94	0.140	0.005	0.999	0.461	0.446	0.719	0.867
0.96	0.140	0.008	0.998	0.487	0.462	0.726	0.885
0.98	0.140	0.012	0.997	0.513	0.478	0.732	0.904
1.00	0.140	0.015	0.994	0.540	0.495	0.737	0.922
1.02	0.140	0.018	0.991	0.568	0.512	0.742	0.941
1.04	0.140	0.022	0.988	0.596	0.530	0.747	0.959
1.06	0.140	0.026	0.984	0.625	0.548	0.752	0.978
1.08	0.140	0.029	0.979	0.654	0.566	0.756	0.996
1.10	0.140	0.033	0.973	0.683	0.585	0.760	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.011	0.998	0.391	0.424	0.677	0.830
0.92	0.160	-.008	0.999	0.415	0.440	0.687	0.848
0.94	0.160	-.005	1.000	0.441	0.456	0.695	0.867
0.96	0.160	-.002	1.000	0.467	0.472	0.703	0.885
0.98	0.160	0.002	1.000	0.493	0.488	0.711	0.904
1.00	0.160	0.005	1.000	0.520	0.505	0.717	0.922
1.02	0.160	0.008	0.999	0.548	0.522	0.724	0.941
1.04	0.160	0.012	0.997	0.576	0.540	0.729	0.959
1.06	0.160	0.016	0.995	0.604	0.558	0.735	0.977
1.08	0.160	0.019	0.993	0.634	0.576	0.740	0.996
1.10	0.160	0.023	0.990	0.663	0.595	0.745	1.014

TABLE B-XIV, cont.

DATA FOR INVERTER, CEA - COMPENSATED
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.021	0.993	0.370	0.434	0.649	0.829
0.92	0.180	-.018	0.995	0.395	0.450	0.660	0.848
0.94	0.180	-.015	0.997	0.421	0.465	0.671	0.866
0.96	0.180	-.012	0.998	0.447	0.482	0.680	0.885
0.98	0.180	-.008	0.999	0.473	0.498	0.689	0.903
1.00	0.180	-.005	1.000	0.500	0.515	0.697	0.922
1.02	0.180	-.002	1.000	0.528	0.532	0.704	0.940
1.04	0.180	0.002	1.000	0.556	0.550	0.711	0.959
1.06	0.180	0.006	1.000	0.584	0.568	0.717	0.977
1.08	0.180	0.009	0.999	0.613	0.586	0.723	0.996
1.10	0.180	0.013	0.997	0.643	0.604	0.729	1.014

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.031	0.988	0.350	0.444	0.619	0.829
0.92	0.200	-.028	0.990	0.375	0.459	0.632	0.848
0.94	0.200	-.025	0.992	0.400	0.475	0.644	0.866
0.96	0.200	-.022	0.994	0.426	0.491	0.655	0.885
0.98	0.200	-.018	0.996	0.453	0.508	0.665	0.903
1.00	0.200	-.015	0.997	0.480	0.525	0.675	0.922
1.02	0.200	-.012	0.998	0.507	0.542	0.683	0.940
1.04	0.200	-.008	0.999	0.535	0.560	0.691	0.959
1.06	0.200	-.004	1.000	0.564	0.578	0.699	0.977
1.08	0.200	-.001	1.000	0.593	0.596	0.706	0.996
1.10	0.200	0.003	1.000	0.623	0.614	0.712	1.014

REALISTIC LOAD REPRESENTATION

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	0.057	0.330	0.598	0.406	0.827	0.820
0.92	0.020	0.060	0.314	0.617	0.417	0.828	0.839
0.94	0.020	0.064	0.299	0.636	0.429	0.829	0.859
0.96	0.020	0.067	0.285	0.656	0.440	0.831	0.879
0.98	0.020	0.071	0.272	0.676	0.451	0.832	0.898
1.00	0.020	0.074	0.260	0.696	0.462	0.833	0.918
1.02	0.020	0.078	0.249	0.715	0.474	0.834	0.937
1.04	0.020	0.082	0.238	0.736	0.485	0.835	0.957
1.06	0.020	0.085	0.228	0.756	0.496	0.836	0.977
1.08	0.020	0.089	0.219	0.776	0.508	0.837	0.996
1.10	0.020	0.093	0.210	0.797	0.519	0.838	1.016

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	0.047	0.647	0.578	0.416	0.811	0.820
0.92	0.040	0.050	0.621	0.597	0.427	0.813	0.839
0.94	0.040	0.054	0.597	0.616	0.439	0.815	0.859
0.96	0.040	0.057	0.573	0.636	0.450	0.816	0.878
0.98	0.040	0.061	0.551	0.656	0.461	0.818	0.898
1.00	0.040	0.064	0.529	0.675	0.472	0.819	0.918
1.02	0.040	0.068	0.508	0.695	0.484	0.821	0.937
1.04	0.040	0.072	0.488	0.716	0.495	0.822	0.957
1.06	0.040	0.075	0.469	0.736	0.506	0.824	0.977
1.08	0.040	0.079	0.451	0.756	0.518	0.825	0.996
1.10	0.040	0.083	0.433	0.777	0.529	0.826	1.016

DATA FOR INVERTER, CEA - COMPENSATED
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	0.037	0.850	0.558	0.426	0.795	0.820
0.92	0.060	0.040	0.829	0.577	0.437	0.797	0.839
0.94	0.060	0.044	0.808	0.596	0.448	0.799	0.859
0.96	0.060	0.047	0.786	0.616	0.460	0.801	0.878
0.98	0.060	0.051	0.764	0.636	0.471	0.803	0.898
1.00	0.060	0.054	0.742	0.655	0.482	0.805	0.918
1.02	0.060	0.058	0.720	0.675	0.494	0.807	0.937
1.04	0.060	0.062	0.698	0.695	0.505	0.809	0.957
1.06	0.060	0.065	0.676	0.716	0.516	0.811	0.977
1.08	0.060	0.069	0.655	0.736	0.528	0.813	0.996
1.10	0.060	0.073	0.634	0.757	0.539	0.814	1.016

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	0.027	0.947	0.538	0.436	0.777	0.819
0.92	0.080	0.030	0.935	0.557	0.447	0.780	0.839
0.94	0.080	0.034	0.921	0.576	0.458	0.783	0.859
0.96	0.080	0.037	0.907	0.596	0.470	0.785	0.878
0.98	0.080	0.041	0.892	0.615	0.481	0.788	0.898
1.00	0.080	0.044	0.875	0.635	0.492	0.790	0.918
1.02	0.080	0.048	0.858	0.655	0.504	0.793	0.937
1.04	0.080	0.052	0.841	0.675	0.515	0.795	0.957
1.06	0.080	0.055	0.822	0.696	0.526	0.797	0.976
1.08	0.080	0.059	0.804	0.716	0.538	0.800	0.996
1.10	0.080	0.063	0.785	0.736	0.549	0.802	1.016

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	0.017	0.986	0.517	0.446	0.758	0.819
0.92	0.100	0.020	0.980	0.537	0.457	0.761	0.839
0.94	0.100	0.024	0.973	0.556	0.468	0.765	0.859
0.96	0.100	0.027	0.965	0.576	0.480	0.768	0.878
0.98	0.100	0.031	0.956	0.595	0.491	0.772	0.898
1.00	0.100	0.034	0.946	0.615	0.502	0.775	0.917
1.02	0.100	0.038	0.935	0.635	0.514	0.778	0.937
1.04	0.100	0.042	0.924	0.655	0.525	0.780	0.957
1.06	0.100	0.045	0.911	0.675	0.536	0.783	0.976
1.08	0.100	0.049	0.897	0.696	0.548	0.786	0.996
1.10	0.100	0.053	0.883	0.716	0.559	0.788	1.016

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	0.007	0.998	0.497	0.456	0.737	0.819
0.92	0.120	0.010	0.996	0.517	0.467	0.742	0.839
0.94	0.120	0.014	0.994	0.536	0.478	0.746	0.858
0.96	0.120	0.017	0.990	0.556	0.490	0.750	0.878
0.98	0.120	0.021	0.986	0.575	0.501	0.754	0.898
1.00	0.120	0.024	0.980	0.595	0.512	0.758	0.917
1.02	0.120	0.028	0.974	0.615	0.524	0.762	0.937
1.04	0.120	0.032	0.967	0.635	0.535	0.765	0.957
1.06	0.120	0.035	0.959	0.655	0.546	0.768	0.976
1.08	0.120	0.039	0.951	0.676	0.558	0.771	0.996
1.10	0.120	0.043	0.941	0.696	0.569	0.774	1.016

TABLE B-XIV, cont.

DATA FOR INVERTER, CEA - COMPENSATED
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.003	1.000	0.477	0.466	0.716	0.819
0.92	0.140	0.000	1.000	0.496	0.477	0.721	0.839
0.94	0.140	0.004	1.000	0.516	0.488	0.726	0.858
0.96	0.140	0.007	0.999	0.535	0.500	0.731	0.878
0.98	0.140	0.011	0.997	0.555	0.511	0.736	0.898
1.00	0.140	0.014	0.995	0.575	0.522	0.740	0.917
1.02	0.140	0.018	0.992	0.595	0.533	0.745	0.937
1.04	0.140	0.021	0.988	0.615	0.545	0.749	0.956
1.06	0.140	0.025	0.984	0.635	0.556	0.752	0.976
1.08	0.140	0.029	0.979	0.656	0.568	0.756	0.996
1.10	0.140	0.033	0.973	0.676	0.579	0.760	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.013	0.997	0.457	0.476	0.693	0.819
0.92	0.160	-.010	0.998	0.476	0.487	0.699	0.839
0.94	0.160	-.006	0.999	0.496	0.498	0.705	0.858
0.96	0.160	-.003	1.000	0.515	0.509	0.711	0.878
0.98	0.160	0.001	1.000	0.535	0.521	0.717	0.897
1.00	0.160	0.004	1.000	0.555	0.532	0.722	0.917
1.02	0.160	0.008	0.999	0.575	0.543	0.727	0.937
1.04	0.160	0.011	0.997	0.595	0.555	0.731	0.956
1.06	0.160	0.015	0.995	0.615	0.566	0.736	0.976
1.08	0.160	0.019	0.993	0.636	0.578	0.740	0.996
1.10	0.160	0.023	0.990	0.656	0.589	0.744	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.023	0.992	0.437	0.486	0.669	0.819
0.92	0.180	-.020	0.994	0.456	0.497	0.676	0.838
0.94	0.180	-.016	0.996	0.476	0.508	0.683	0.858
0.96	0.180	-.013	0.997	0.495	0.519	0.690	0.878
0.98	0.180	-.009	0.999	0.515	0.531	0.696	0.897
1.00	0.180	-.006	0.999	0.535	0.542	0.702	0.917
1.02	0.180	-.002	1.000	0.555	0.553	0.708	0.937
1.04	0.180	0.001	1.000	0.575	0.565	0.713	0.956
1.06	0.180	0.005	1.000	0.595	0.576	0.718	0.976
1.08	0.180	0.009	0.999	0.615	0.587	0.723	0.996
1.10	0.180	0.013	0.997	0.636	0.599	0.728	1.015

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.033	0.987	0.417	0.496	0.644	0.819
0.92	0.200	-.030	0.989	0.436	0.507	0.652	0.838
0.94	0.200	-.026	0.991	0.456	0.518	0.660	0.858
0.96	0.200	-.023	0.993	0.475	0.529	0.668	0.878
0.98	0.200	-.020	0.995	0.495	0.541	0.675	0.897
1.00	0.200	-.016	0.997	0.515	0.552	0.682	0.917
1.02	0.200	-.012	0.998	0.535	0.563	0.688	0.936
1.04	0.200	-.009	0.999	0.555	0.575	0.695	0.956
1.06	0.200	-.005	1.000	0.575	0.586	0.700	0.976
1.08	0.200	-.001	1.000	0.595	0.597	0.706	0.995
1.10	0.200	0.003	1.000	0.616	0.609	0.711	1.015

TABLE B-XV

ORIGINAL PAGE IS OF POOR QUALITY

CONSTANT IMPEDANCE LOAD

DATA FOR PV INVERTER LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.062	0.307	0.043	0.109	0.365	0.886
0.92	0.020	-.062	0.307	0.046	0.111	0.380	0.906
0.94	0.020	-.062	0.307	0.049	0.113	0.394	0.926
0.96	0.020	-.062	0.307	0.052	0.116	0.407	0.946
0.98	0.020	-.062	0.307	0.055	0.118	0.420	0.966
1.00	0.020	-.062	0.307	0.058	0.120	0.433	0.986
1.02	0.020	-.062	0.307	0.061	0.123	0.445	1.005
1.04	0.020	-.062	0.307	0.064	0.125	0.456	1.025
1.06	0.020	-.062	0.307	0.067	0.128	0.467	1.045
1.08	0.020	-.062	0.307	0.071	0.130	0.478	1.065
1.10	0.020	-.062	0.307	0.074	0.133	0.488	1.085

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.064	0.530	0.023	0.111	0.201	0.886
0.92	0.040	-.064	0.530	0.026	0.113	0.221	0.906
0.94	0.040	-.064	0.530	0.029	0.115	0.241	0.926
0.96	0.040	-.064	0.530	0.032	0.118	0.260	0.946
0.98	0.040	-.064	0.530	0.035	0.120	0.278	0.966
1.00	0.040	-.064	0.530	0.038	0.122	0.295	0.986
1.02	0.040	-.064	0.530	0.041	0.125	0.312	1.006
1.04	0.040	-.064	0.530	0.044	0.127	0.328	1.026
1.06	0.040	-.064	0.530	0.048	0.130	0.344	1.046
1.08	0.040	-.064	0.530	0.051	0.132	0.359	1.066
1.10	0.040	-.064	0.530	0.054	0.135	0.374	1.086

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.066	0.673	0.003	0.113	0.026	0.887
0.92	0.060	-.066	0.673	0.006	0.115	0.050	0.907
0.94	0.060	-.066	0.673	0.009	0.118	0.074	0.927
0.96	0.060	-.066	0.673	0.012	0.120	0.097	0.947
0.98	0.060	-.066	0.673	0.015	0.122	0.120	0.967
1.00	0.060	-.066	0.673	0.018	0.124	0.142	0.987
1.02	0.060	-.066	0.673	0.021	0.127	0.164	1.007
1.04	0.060	-.066	0.673	0.024	0.129	0.185	1.026
1.06	0.060	-.066	0.673	0.028	0.132	0.205	1.046
1.08	0.060	-.066	0.673	0.031	0.134	0.225	1.066
1.10	0.060	-.066	0.673	0.034	0.137	0.244	1.086

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.068	0.762	-.017	0.115	0.146	0.888
0.92	0.080	-.068	0.762	-.014	0.117	0.119	0.908
0.94	0.080	-.068	0.762	-.011	0.120	0.093	0.928
0.96	0.080	-.068	0.762	-.008	0.122	0.067	0.948
0.98	0.080	-.068	0.762	-.005	0.124	0.041	0.967
1.00	0.080	-.068	0.762	-.002	0.126	0.016	0.987
1.02	0.080	-.068	0.762	0.001	0.129	0.009	1.007
1.04	0.080	-.068	0.762	0.004	0.131	0.033	1.027
1.06	0.080	-.068	0.762	0.008	0.134	0.057	1.047
1.08	0.080	-.068	0.762	0.011	0.136	0.081	1.067
1.10	0.080	-.068	0.762	0.014	0.139	0.104	1.087

DATA FOR PV INVERTER
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.070	0.819	-.037	0.117	0.300	0.888
0.92	0.100	-.070	0.819	-.034	0.120	0.274	0.908
0.94	0.100	-.070	0.819	-.031	0.122	0.247	0.928
0.96	0.100	-.070	0.819	-.028	0.124	0.221	0.948
0.98	0.100	-.070	0.819	-.025	0.126	0.195	0.968
1.00	0.100	-.070	0.819	-.022	0.129	0.168	0.988
1.02	0.100	-.070	0.819	-.019	0.131	0.142	1.008
1.04	0.100	-.070	0.819	-.016	0.133	0.116	1.028
1.06	0.100	-.070	0.819	-.012	0.136	0.090	1.047
1.08	0.100	-.070	0.819	-.009	0.138	0.064	1.067
1.10	0.100	-.070	0.819	-.005	0.141	0.039	1.087

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.072	0.857	-.057	0.119	0.429	0.889
0.92	0.120	-.072	0.857	-.054	0.122	0.405	0.909
0.94	0.120	-.072	0.857	-.051	0.124	0.381	0.929
0.96	0.120	-.072	0.857	-.048	0.126	0.356	0.949
0.98	0.120	-.072	0.857	-.045	0.128	0.331	0.969
1.00	0.120	-.072	0.857	-.042	0.131	0.305	0.988
1.02	0.120	-.072	0.857	-.039	0.133	0.279	1.008
1.04	0.120	-.072	0.857	-.035	0.135	0.253	1.028
1.06	0.120	-.072	0.857	-.032	0.138	0.227	1.048
1.08	0.120	-.072	0.857	-.029	0.140	0.201	1.068
1.10	0.120	-.072	0.857	-.025	0.143	0.175	1.088

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.074	0.884	-.077	0.121	0.534	0.890
0.92	0.140	-.074	0.884	-.074	0.124	0.513	0.910
0.94	0.140	-.074	0.884	-.071	0.126	0.491	0.929
0.96	0.140	-.074	0.884	-.068	0.128	0.468	0.949
0.98	0.140	-.074	0.884	-.065	0.130	0.445	0.969
1.00	0.140	-.074	0.884	-.062	0.133	0.422	0.989
1.02	0.140	-.074	0.884	-.059	0.135	0.398	1.009
1.04	0.140	-.074	0.884	-.055	0.137	0.373	1.029
1.06	0.140	-.074	0.884	-.052	0.140	0.348	1.049
1.08	0.140	-.074	0.884	-.049	0.142	0.323	1.068
1.10	0.140	-.074	0.884	-.045	0.145	0.298	1.088

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.076	0.903	-.097	0.124	0.616	0.890
0.92	0.160	-.076	0.903	-.094	0.126	0.598	0.910
0.94	0.160	-.076	0.903	-.091	0.128	0.579	0.930
0.96	0.160	-.076	0.903	-.088	0.130	0.559	0.950
0.98	0.160	-.076	0.903	-.085	0.132	0.539	0.970
1.00	0.160	-.076	0.903	-.082	0.135	0.518	0.990
1.02	0.160	-.076	0.903	-.078	0.137	0.497	1.009
1.04	0.160	-.076	0.903	-.075	0.140	0.475	1.029
1.06	0.160	-.076	0.903	-.072	0.142	0.452	1.049
1.08	0.160	-.076	0.903	-.069	0.145	0.429	1.069
1.10	0.160	-.076	0.903	-.065	0.147	0.405	1.089

DATA FOR PV INVERTER
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.078	0.918	-.117	0.126	0.680	0.891
0.92	0.180	-.078	0.918	-.114	0.128	0.665	0.911
0.94	0.180	-.078	0.918	-.111	0.130	0.648	0.931
0.96	0.180	-.078	0.918	-.108	0.132	0.632	0.950
0.98	0.180	-.078	0.918	-.105	0.134	0.614	0.970
1.00	0.180	-.078	0.918	-.102	0.137	0.596	0.990
1.02	0.180	-.078	0.918	-.098	0.139	0.577	1.010
1.04	0.180	-.078	0.918	-.095	0.142	0.558	1.030
1.06	0.180	-.078	0.918	-.092	0.144	0.537	1.050
1.08	0.180	-.078	0.918	-.088	0.147	0.517	1.070
1.10	0.180	-.078	0.918	-.085	0.149	0.495	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.080	0.928	-.136	0.128	0.730	0.891
0.92	0.200	-.080	0.928	-.134	0.130	0.717	0.911
0.94	0.200	-.080	0.928	-.131	0.132	0.703	0.931
0.96	0.200	-.080	0.928	-.128	0.134	0.689	0.951
0.98	0.200	-.080	0.928	-.125	0.137	0.674	0.971
1.00	0.200	-.080	0.928	-.121	0.139	0.658	0.991
1.02	0.200	-.080	0.928	-.118	0.141	0.642	1.011
1.04	0.200	-.080	0.928	-.115	0.144	0.625	1.030
1.06	0.200	-.080	0.928	-.112	0.146	0.607	1.050
1.08	0.200	-.080	0.928	-.108	0.149	0.589	1.070
1.10	0.200	-.080	0.928	-.105	0.151	0.570	1.090

REALISTIC LOAD REPRESENTATION

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.062	0.307	0.048	0.113	0.392	0.885
0.92	0.020	-.062	0.307	0.050	0.115	0.401	0.905
0.94	0.020	-.062	0.307	0.052	0.116	0.410	0.925
0.96	0.020	-.062	0.307	0.054	0.118	0.419	0.945
0.98	0.020	-.062	0.307	0.056	0.119	0.427	0.965
1.00	0.020	-.062	0.307	0.058	0.121	0.436	0.985
1.02	0.020	-.062	0.307	0.061	0.122	0.443	1.005
1.04	0.020	-.062	0.307	0.063	0.124	0.451	1.025
1.06	0.020	-.062	0.307	0.065	0.126	0.458	1.045
1.08	0.020	-.062	0.307	0.067	0.127	0.465	1.066
1.10	0.020	-.062	0.307	0.069	0.129	0.472	1.086

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.064	0.530	0.028	0.115	0.239	0.886
0.92	0.040	-.064	0.530	0.030	0.117	0.251	0.906
0.94	0.040	-.064	0.530	0.032	0.118	0.264	0.926
0.96	0.040	-.064	0.530	0.034	0.120	0.276	0.946
0.98	0.040	-.064	0.530	0.036	0.121	0.288	0.966
1.00	0.040	-.064	0.530	0.039	0.123	0.299	0.986
1.02	0.040	-.064	0.530	0.041	0.124	0.310	1.006
1.04	0.040	-.064	0.530	0.043	0.126	0.321	1.026
1.06	0.040	-.064	0.530	0.045	0.128	0.331	1.046
1.08	0.040	-.064	0.530	0.047	0.129	0.341	1.066
1.10	0.040	-.064	0.530	0.049	0.131	0.351	1.086

TABLE B-XV, cont.

DATA FOR PV INVERTER
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.066	0.673	0.008	0.117	0.071	0.886
0.92	0.060	-.066	0.673	0.010	0.119	0.087	0.906
0.94	0.060	-.066	0.673	0.012	0.120	0.103	0.926
0.96	0.060	-.066	0.673	0.014	0.122	0.118	0.946
0.98	0.060	-.066	0.673	0.017	0.123	0.133	0.967
1.00	0.060	-.066	0.673	0.019	0.125	0.147	0.987
1.02	0.060	-.066	0.673	0.021	0.127	0.161	1.007
1.04	0.060	-.066	0.673	0.023	0.128	0.175	1.027
1.06	0.060	-.066	0.673	0.025	0.130	0.188	1.047
1.08	0.060	-.066	0.673	0.027	0.131	0.201	1.067
1.10	0.060	-.066	0.673	0.029	0.133	0.214	1.087

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.068	0.762	-.012	0.119	0.096	0.887
0.92	0.080	-.068	0.762	-.010	0.121	0.079	0.907
0.94	0.080	-.068	0.762	-.007	0.122	0.061	0.927
0.96	0.080	-.068	0.762	-.005	0.124	0.044	0.947
0.98	0.080	-.068	0.762	-.003	0.125	0.027	0.967
1.00	0.080	-.068	0.762	-.001	0.127	0.010	0.987
1.02	0.080	-.068	0.762	0.001	0.129	0.006	1.007
1.04	0.080	-.068	0.762	0.003	0.130	0.022	1.027
1.06	0.080	-.068	0.762	0.005	0.132	0.038	1.047
1.08	0.080	-.068	0.762	0.007	0.133	0.053	1.067
1.10	0.080	-.068	0.762	0.009	0.135	0.068	1.087

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.070	0.819	-.031	0.121	0.251	0.888
0.92	0.100	-.070	0.819	-.029	0.123	0.233	0.908
0.94	0.100	-.070	0.819	-.027	0.124	0.215	0.928
0.96	0.100	-.070	0.819	-.025	0.126	0.198	0.948
0.98	0.100	-.070	0.819	-.023	0.127	0.180	0.968
1.00	0.100	-.070	0.819	-.021	0.129	0.163	0.988
1.02	0.100	-.070	0.819	-.019	0.131	0.145	1.008
1.04	0.100	-.070	0.819	-.017	0.132	0.128	1.028
1.06	0.100	-.070	0.819	-.015	0.134	0.111	1.048
1.08	0.100	-.070	0.819	-.013	0.135	0.095	1.068
1.10	0.100	-.070	0.819	-.011	0.137	0.078	1.088

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.072	0.857	-.051	0.123	0.384	0.888
0.92	0.120	-.072	0.857	-.049	0.125	0.368	0.908
0.94	0.120	-.072	0.857	-.047	0.126	0.351	0.928
0.96	0.120	-.072	0.857	-.045	0.128	0.334	0.948
0.98	0.120	-.072	0.857	-.043	0.130	0.317	0.968
1.00	0.120	-.072	0.857	-.041	0.131	0.300	0.988
1.02	0.120	-.072	0.857	-.039	0.133	0.283	1.008
1.04	0.120	-.072	0.857	-.037	0.134	0.266	1.028
1.06	0.120	-.072	0.857	-.035	0.136	0.249	1.048
1.08	0.120	-.072	0.857	-.033	0.137	0.232	1.068
1.10	0.120	-.072	0.857	-.031	0.139	0.216	1.088

DATA FOR PV INVERTER
LIGHT LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.074	0.884	-.071	0.125	0.494	0.889
0.92	0.140	-.074	0.884	-.069	0.127	0.479	0.909
0.94	0.140	-.074	0.884	-.067	0.129	0.464	0.929
0.96	0.140	-.074	0.884	-.065	0.130	0.449	0.949
0.98	0.140	-.074	0.884	-.063	0.132	0.433	0.969
1.00	0.140	-.074	0.884	-.061	0.133	0.417	0.989
1.02	0.140	-.074	0.884	-.059	0.135	0.402	1.009
1.04	0.140	-.074	0.884	-.057	0.136	0.386	1.029
1.06	0.140	-.074	0.884	-.055	0.138	0.370	1.049
1.08	0.140	-.074	0.884	-.053	0.139	0.354	1.069
1.10	0.140	-.074	0.884	-.051	0.141	0.338	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.076	0.903	-.091	0.128	0.582	0.890
0.92	0.160	-.076	0.903	-.089	0.129	0.569	0.910
0.94	0.160	-.076	0.903	-.087	0.131	0.556	0.930
0.96	0.160	-.076	0.903	-.085	0.132	0.542	0.950
0.98	0.160	-.076	0.903	-.083	0.134	0.528	0.970
1.00	0.160	-.076	0.903	-.081	0.135	0.514	0.990
1.02	0.160	-.076	0.903	-.079	0.137	0.500	1.010
1.04	0.160	-.076	0.903	-.077	0.138	0.486	1.029
1.06	0.160	-.076	0.903	-.075	0.140	0.472	1.049
1.08	0.160	-.076	0.903	-.073	0.141	0.457	1.069
1.10	0.160	-.076	0.903	-.071	0.143	0.442	1.089

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.078	0.918	-.111	0.130	0.651	0.890
0.92	0.180	-.078	0.918	-.109	0.131	0.640	0.910
0.94	0.180	-.078	0.918	-.107	0.133	0.629	0.930
0.96	0.180	-.078	0.918	-.105	0.134	0.617	0.950
0.98	0.180	-.078	0.918	-.103	0.136	0.605	0.970
1.00	0.180	-.078	0.918	-.101	0.137	0.593	0.990
1.02	0.180	-.078	0.918	-.099	0.139	0.581	1.010
1.04	0.180	-.078	0.918	-.097	0.140	0.568	1.030
1.06	0.180	-.078	0.918	-.095	0.142	0.555	1.050
1.08	0.180	-.078	0.918	-.093	0.144	0.542	1.070
1.10	0.180	-.078	0.918	-.091	0.145	0.529	1.090

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.080	0.928	-.131	0.132	0.706	0.891
0.92	0.200	-.080	0.928	-.129	0.133	0.696	0.911
0.94	0.200	-.080	0.928	-.127	0.135	0.686	0.931
0.96	0.200	-.080	0.928	-.125	0.136	0.676	0.951
0.98	0.200	-.080	0.928	-.123	0.138	0.666	0.971
1.00	0.200	-.080	0.928	-.121	0.139	0.656	0.991
1.02	0.200	-.080	0.928	-.119	0.141	0.645	1.011
1.04	0.200	-.080	0.928	-.117	0.142	0.634	1.031
1.06	0.200	-.080	0.928	-.115	0.144	0.623	1.051
1.08	0.200	-.080	0.928	-.113	0.146	0.612	1.071
1.10	0.200	-.080	0.928	-.110	0.147	0.600	1.090

TABLE B-XVI

ORIGINAL PAGE IS
OF POOR QUALITY

CONSTANT IMPEDANCE LOAD

DATA FOR PV INVERTER
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.062	0.307	0.514	0.463	0.743	0.817
0.92	0.020	-.062	0.307	0.539	0.481	0.746	0.836
0.94	0.020	-.062	0.307	0.564	0.500	0.748	0.854
0.96	0.020	-.062	0.307	0.589	0.519	0.750	0.873
0.98	0.020	-.062	0.307	0.615	0.538	0.753	0.891
1.00	0.020	-.062	0.307	0.642	0.558	0.754	0.909
1.02	0.020	-.062	0.307	0.669	0.578	0.756	0.928
1.04	0.020	-.062	0.307	0.696	0.599	0.758	0.946
1.06	0.020	-.062	0.307	0.724	0.620	0.760	0.965
1.08	0.020	-.062	0.307	0.753	0.642	0.761	0.983
1.10	0.020	-.062	0.307	0.782	0.664	0.763	1.001

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.064	0.530	0.495	0.465	0.729	0.818
0.92	0.040	-.064	0.530	0.520	0.484	0.732	0.836
0.94	0.040	-.064	0.530	0.545	0.503	0.735	0.855
0.96	0.040	-.064	0.530	0.570	0.522	0.738	0.873
0.98	0.040	-.064	0.530	0.596	0.541	0.740	0.892
1.00	0.040	-.064	0.530	0.623	0.561	0.743	0.910
1.02	0.040	-.064	0.530	0.650	0.581	0.745	0.928
1.04	0.040	-.064	0.530	0.677	0.602	0.747	0.947
1.06	0.040	-.064	0.530	0.705	0.623	0.749	0.965
1.08	0.040	-.064	0.530	0.734	0.644	0.751	0.984
1.10	0.040	-.064	0.530	0.763	0.666	0.753	1.002

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.066	0.673	0.476	0.468	0.713	0.819
0.92	0.060	-.066	0.673	0.501	0.487	0.717	0.837
0.94	0.060	-.066	0.673	0.526	0.505	0.721	0.856
0.96	0.060	-.066	0.673	0.551	0.524	0.724	0.874
0.98	0.060	-.066	0.673	0.577	0.544	0.728	0.892
1.00	0.060	-.066	0.673	0.604	0.564	0.731	0.911
1.02	0.060	-.066	0.673	0.631	0.584	0.734	0.929
1.04	0.060	-.066	0.673	0.658	0.605	0.736	0.947
1.06	0.060	-.066	0.673	0.686	0.626	0.739	0.966
1.08	0.060	-.066	0.673	0.715	0.647	0.741	0.984
1.10	0.060	-.066	0.673	0.744	0.669	0.744	1.003

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.068	0.762	0.457	0.471	0.697	0.820
0.92	0.080	-.068	0.762	0.482	0.489	0.702	0.838
0.94	0.080	-.068	0.762	0.507	0.508	0.706	0.856
0.96	0.080	-.068	0.762	0.532	0.527	0.710	0.875
0.98	0.080	-.068	0.762	0.558	0.547	0.714	0.893
1.00	0.080	-.068	0.762	0.585	0.566	0.718	0.911
1.02	0.080	-.068	0.762	0.612	0.587	0.722	0.930
1.04	0.080	-.068	0.762	0.639	0.607	0.725	0.948
1.06	0.080	-.068	0.762	0.667	0.628	0.728	0.966
1.08	0.080	-.068	0.762	0.696	0.650	0.731	0.985
1.10	0.080	-.068	0.762	0.725	0.672	0.734	1.003

DATA FOR PV INVERTER
HEAVY LOAD CASE

ORIGINAL PAGE IS
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SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.070	0.819	0.438	0.474	0.679	0.820
0.92	0.100	-.070	0.819	0.463	0.492	0.685	0.839
0.94	0.100	-.070	0.819	0.488	0.511	0.691	0.857
0.96	0.100	-.070	0.819	0.513	0.530	0.696	0.875
0.98	0.100	-.070	0.819	0.539	0.549	0.700	0.894
1.00	0.100	-.070	0.819	0.566	0.569	0.705	0.912
1.02	0.100	-.070	0.819	0.593	0.589	0.709	0.930
1.04	0.100	-.070	0.819	0.620	0.610	0.713	0.949
1.06	0.100	-.070	0.819	0.648	0.631	0.716	0.967
1.08	0.100	-.070	0.819	0.677	0.653	0.720	0.985
1.10	0.100	-.070	0.819	0.706	0.675	0.723	1.004

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.072	0.857	0.419	0.476	0.661	0.821
0.92	0.120	-.072	0.857	0.444	0.495	0.668	0.839
0.94	0.120	-.072	0.857	0.469	0.513	0.674	0.858
0.96	0.120	-.072	0.857	0.494	0.533	0.680	0.876
0.98	0.120	-.072	0.857	0.520	0.552	0.686	0.894
1.00	0.120	-.072	0.857	0.547	0.572	0.691	0.913
1.02	0.120	-.072	0.857	0.574	0.592	0.696	0.931
1.04	0.120	-.072	0.857	0.601	0.613	0.700	0.949
1.06	0.120	-.072	0.857	0.629	0.634	0.704	0.968
1.08	0.120	-.072	0.857	0.658	0.655	0.708	0.986
1.10	0.120	-.072	0.857	0.687	0.677	0.712	1.004

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.074	0.884	0.400	0.479	0.641	0.822
0.92	0.140	-.074	0.884	0.425	0.498	0.649	0.840
0.94	0.140	-.074	0.884	0.450	0.516	0.657	0.859
0.96	0.140	-.074	0.884	0.475	0.535	0.664	0.877
0.98	0.140	-.074	0.884	0.501	0.555	0.670	0.895
1.00	0.140	-.074	0.884	0.528	0.575	0.676	0.913
1.02	0.140	-.074	0.884	0.555	0.595	0.682	0.932
1.04	0.140	-.074	0.884	0.582	0.616	0.687	0.950
1.06	0.140	-.074	0.884	0.610	0.637	0.692	0.968
1.08	0.140	-.074	0.884	0.639	0.658	0.697	0.987
1.10	0.140	-.074	0.884	0.668	0.680	0.701	1.005

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.076	0.903	0.381	0.482	0.620	0.823
0.92	0.160	-.076	0.903	0.406	0.500	0.630	0.841
0.94	0.160	-.076	0.903	0.431	0.519	0.639	0.859
0.96	0.160	-.076	0.903	0.456	0.538	0.647	0.878
0.98	0.160	-.076	0.903	0.482	0.558	0.654	0.896
1.00	0.160	-.076	0.903	0.509	0.577	0.661	0.914
1.02	0.160	-.076	0.903	0.536	0.598	0.667	0.932
1.04	0.160	-.076	0.903	0.563	0.618	0.673	0.951
1.06	0.160	-.076	0.903	0.591	0.639	0.679	0.969
1.08	0.160	-.076	0.903	0.620	0.661	0.684	0.987
1.10	0.160	-.076	0.903	0.649	0.683	0.689	1.006

DATA FOR PV INVERTER
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.078	0.918	0.362	0.485	0.599	0.823
0.92	0.180	-.078	0.918	0.387	0.503	0.609	0.842
0.94	0.180	-.078	0.918	0.412	0.522	0.619	0.860
0.96	0.180	-.078	0.918	0.437	0.541	0.629	0.878
0.98	0.180	-.078	0.918	0.463	0.560	0.637	0.897
1.00	0.180	-.078	0.918	0.489	0.580	0.645	0.915
1.02	0.180	-.078	0.918	0.517	0.600	0.652	0.933
1.04	0.180	-.078	0.918	0.544	0.621	0.659	0.951
1.06	0.180	-.078	0.918	0.572	0.642	0.665	0.970
1.08	0.180	-.078	0.918	0.601	0.664	0.671	0.988
1.10	0.180	-.078	0.918	0.630	0.686	0.677	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.080	0.928	0.343	0.487	0.576	0.824
0.92	0.200	-.080	0.928	0.368	0.506	0.588	0.842
0.94	0.200	-.080	0.928	0.393	0.524	0.599	0.861
0.96	0.200	-.080	0.928	0.418	0.543	0.610	0.879
0.98	0.200	-.080	0.928	0.444	0.563	0.619	0.897
1.00	0.200	-.080	0.928	0.470	0.583	0.628	0.915
1.02	0.200	-.080	0.928	0.498	0.603	0.636	0.934
1.04	0.200	-.080	0.928	0.525	0.624	0.644	0.952
1.06	0.200	-.080	0.928	0.553	0.645	0.651	0.970
1.08	0.200	-.080	0.928	0.582	0.666	0.658	0.989
1.10	0.200	-.080	0.928	0.611	0.688	0.664	1.007

REALISTIC LOAD REPRESENTATION

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.020	-.062	0.307	0.584	0.515	0.750	0.806
0.92	0.020	-.062	0.307	0.603	0.530	0.752	0.825
0.94	0.020	-.062	0.307	0.623	0.544	0.753	0.845
0.96	0.020	-.062	0.307	0.642	0.558	0.754	0.864
0.98	0.020	-.062	0.307	0.662	0.573	0.756	0.884
1.00	0.020	-.062	0.307	0.681	0.588	0.757	0.904
1.02	0.020	-.062	0.307	0.701	0.603	0.758	0.923
1.04	0.020	-.062	0.307	0.721	0.618	0.759	0.943
1.06	0.020	-.062	0.307	0.741	0.633	0.760	0.962
1.08	0.020	-.062	0.307	0.761	0.648	0.762	0.982
1.10	0.020	-.062	0.307	0.781	0.663	0.762	1.001

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.040	-.064	0.530	0.565	0.518	0.737	0.807
0.92	0.040	-.064	0.530	0.584	0.532	0.739	0.826
0.94	0.040	-.064	0.530	0.603	0.547	0.741	0.846
0.96	0.040	-.064	0.530	0.623	0.561	0.743	0.865
0.98	0.040	-.064	0.530	0.642	0.576	0.745	0.885
1.00	0.040	-.064	0.530	0.662	0.590	0.746	0.904
1.02	0.040	-.064	0.530	0.682	0.605	0.748	0.924
1.04	0.040	-.064	0.530	0.702	0.620	0.749	0.943
1.06	0.040	-.064	0.530	0.722	0.635	0.751	0.963
1.08	0.040	-.064	0.530	0.742	0.650	0.752	0.982
1.10	0.040	-.064	0.530	0.762	0.666	0.753	1.002

DATA FOR PV INVERTER
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.060	-.066	0.673	0.546	0.520	0.724	0.808
0.92	0.060	-.066	0.673	0.565	0.535	0.726	0.827
0.94	0.060	-.066	0.673	0.584	0.549	0.729	0.847
0.96	0.060	-.066	0.673	0.604	0.564	0.731	0.866
0.98	0.060	-.066	0.673	0.623	0.578	0.733	0.886
1.00	0.060	-.066	0.673	0.643	0.593	0.735	0.905
1.02	0.060	-.066	0.673	0.662	0.608	0.737	0.925
1.04	0.060	-.066	0.673	0.682	0.623	0.739	0.944
1.06	0.060	-.066	0.673	0.702	0.638	0.740	0.964
1.08	0.060	-.066	0.673	0.723	0.653	0.742	0.983
1.10	0.060	-.066	0.673	0.743	0.668	0.744	1.003

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.080	-.068	0.762	0.527	0.523	0.710	0.808
0.92	0.080	-.068	0.762	0.546	0.537	0.713	0.828
0.94	0.080	-.068	0.762	0.565	0.552	0.715	0.847
0.96	0.080	-.068	0.762	0.584	0.566	0.718	0.867
0.98	0.080	-.068	0.762	0.604	0.581	0.721	0.886
1.00	0.080	-.068	0.762	0.623	0.596	0.723	0.906
1.02	0.080	-.068	0.762	0.643	0.610	0.725	0.925
1.04	0.080	-.068	0.762	0.663	0.625	0.728	0.945
1.06	0.080	-.068	0.762	0.683	0.640	0.730	0.964
1.08	0.080	-.068	0.762	0.703	0.655	0.732	0.984
1.10	0.080	-.068	0.762	0.724	0.671	0.733	1.003

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.100	-.070	0.819	0.508	0.526	0.695	0.809
0.92	0.100	-.070	0.819	0.527	0.540	0.698	0.829
0.94	0.100	-.070	0.819	0.546	0.554	0.702	0.848
0.96	0.100	-.070	0.819	0.565	0.569	0.705	0.868
0.98	0.100	-.070	0.819	0.585	0.583	0.708	0.887
1.00	0.100	-.070	0.819	0.604	0.598	0.711	0.907
1.02	0.100	-.070	0.819	0.624	0.613	0.713	0.926
1.04	0.100	-.070	0.819	0.644	0.628	0.716	0.946
1.06	0.100	-.070	0.819	0.664	0.643	0.718	0.965
1.08	0.100	-.070	0.819	0.684	0.658	0.721	0.985
1.10	0.100	-.070	0.819	0.704	0.673	0.723	1.004

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.120	-.072	0.857	0.488	0.528	0.679	0.810
0.92	0.120	-.072	0.857	0.507	0.543	0.683	0.829
0.94	0.120	-.072	0.857	0.527	0.557	0.687	0.849
0.96	0.120	-.072	0.857	0.546	0.571	0.691	0.868
0.98	0.120	-.072	0.857	0.565	0.586	0.694	0.888
1.00	0.120	-.072	0.857	0.585	0.601	0.698	0.907
1.02	0.120	-.072	0.857	0.605	0.615	0.701	0.927
1.04	0.120	-.072	0.857	0.625	0.630	0.704	0.946
1.06	0.120	-.072	0.857	0.645	0.645	0.707	0.966
1.08	0.120	-.072	0.857	0.665	0.660	0.709	0.985
1.10	0.120	-.072	0.857	0.685	0.676	0.712	1.005

DATA FOR PV INVERTER
HEAVY LOAD CASE

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.140	-.074	0.884	0.469	0.531	0.662	0.811
0.92	0.140	-.074	0.884	0.488	0.545	0.667	0.830
0.94	0.140	-.074	0.884	0.507	0.559	0.672	0.850
0.96	0.140	-.074	0.884	0.527	0.574	0.676	0.869
0.98	0.140	-.074	0.884	0.546	0.589	0.680	0.889
1.00	0.140	-.074	0.884	0.566	0.603	0.684	0.908
1.02	0.140	-.074	0.884	0.585	0.618	0.688	0.927
1.04	0.140	-.074	0.884	0.605	0.633	0.691	0.947
1.06	0.140	-.074	0.884	0.625	0.648	0.694	0.966
1.08	0.140	-.074	0.884	0.645	0.663	0.697	0.986
1.10	0.140	-.074	0.884	0.666	0.678	0.700	1.005

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.160	-.076	0.903	0.450	0.533	0.645	0.812
0.92	0.160	-.076	0.903	0.469	0.548	0.650	0.831
0.94	0.160	-.076	0.903	0.488	0.562	0.656	0.850
0.96	0.160	-.076	0.903	0.507	0.577	0.661	0.870
0.98	0.160	-.076	0.903	0.527	0.591	0.665	0.889
1.00	0.160	-.076	0.903	0.546	0.606	0.670	0.909
1.02	0.160	-.076	0.903	0.566	0.621	0.674	0.928
1.04	0.160	-.076	0.903	0.586	0.635	0.678	0.948
1.06	0.160	-.076	0.903	0.606	0.650	0.682	0.967
1.08	0.160	-.076	0.903	0.626	0.666	0.685	0.987
1.10	0.160	-.076	0.903	0.646	0.681	0.689	1.006

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.180	-.078	0.918	0.431	0.536	0.626	0.813
0.92	0.180	-.078	0.918	0.450	0.550	0.633	0.832
0.94	0.180	-.078	0.918	0.469	0.565	0.639	0.851
0.96	0.180	-.078	0.918	0.488	0.579	0.644	0.871
0.98	0.180	-.078	0.918	0.508	0.594	0.650	0.890
1.00	0.180	-.078	0.918	0.527	0.608	0.655	0.909
1.02	0.180	-.078	0.918	0.547	0.623	0.660	0.929
1.04	0.180	-.078	0.918	0.567	0.638	0.664	0.948
1.06	0.180	-.078	0.918	0.587	0.653	0.668	0.968
1.08	0.180	-.078	0.918	0.607	0.668	0.672	0.987
1.10	0.180	-.078	0.918	0.627	0.683	0.676	1.007

SYS V	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.200	-.080	0.928	0.412	0.539	0.607	0.813
0.92	0.200	-.080	0.928	0.430	0.553	0.614	0.833
0.94	0.200	-.080	0.928	0.450	0.567	0.621	0.852
0.96	0.200	-.080	0.928	0.469	0.582	0.628	0.871
0.98	0.200	-.080	0.928	0.488	0.596	0.634	0.891
1.00	0.200	-.080	0.928	0.508	0.611	0.639	0.910
1.02	0.200	-.080	0.928	0.528	0.626	0.645	0.930
1.04	0.200	-.080	0.928	0.547	0.641	0.650	0.949
1.06	0.200	-.080	0.928	0.567	0.655	0.654	0.968
1.08	0.200	-.080	0.928	0.587	0.671	0.659	0.988
1.10	0.200	-.080	0.928	0.608	0.686	0.663	1.007

TABLE XVII

DATA FOR BASE CASE
LIGHT LOAD

CONSTANT IMPEDANCE LOAD

SYS V	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.064	0.048	0.800	0.892
0.92	0.066	0.050	0.800	0.912
0.94	0.069	0.052	0.800	0.931
0.96	0.072	0.054	0.800	0.951
0.98	0.075	0.057	0.800	0.971
1.00	0.079	0.059	0.800	0.991
1.02	0.082	0.061	0.800	1.011
1.04	0.085	0.064	0.800	1.030
1.06	0.088	0.066	0.800	1.050
1.08	0.092	0.069	0.800	1.070
1.10	0.095	0.071	0.800	1.090

REALISTIC LOAD REPRESENTATION

SYS V	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.069	0.052	0.800	0.891
0.92	0.071	0.053	0.800	0.911
0.94	0.073	0.055	0.800	0.931
0.96	0.075	0.056	0.800	0.951
0.98	0.077	0.058	0.800	0.971
1.00	0.079	0.059	0.800	0.991
1.02	0.081	0.061	0.800	1.011
1.04	0.083	0.062	0.800	1.031
1.06	0.085	0.064	0.800	1.051
1.08	0.087	0.066	0.800	1.071
1.10	0.090	0.067	0.800	1.091

TABLE B-XVII

DATA FOR BASE CASE
HEAVY LOAD

CONSTANT IMPEDANCE LOAD

SYS V	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.542	0.407	0.800	0.823
0.92	0.566	0.425	0.800	0.841
0.94	0.591	0.443	0.800	0.860
0.96	0.617	0.462	0.800	0.878
0.98	0.643	0.482	0.800	0.896
1.00	0.669	0.502	0.800	0.915
1.02	0.696	0.522	0.800	0.933
1.04	0.724	0.543	0.800	0.951
1.06	0.752	0.564	0.800	0.969
1.08	0.780	0.585	0.800	0.988
1.10	0.810	0.607	0.800	1.006

REALISTIC LOAD REPRESENTATION

SYS V	SYS P	SYS Q	SYS PF	LOAD V
0.90	0.610	0.458	0.800	0.812
0.92	0.629	0.472	0.800	0.831
0.94	0.648	0.486	0.800	0.851
0.96	0.668	0.501	0.800	0.870
0.98	0.687	0.515	0.800	0.890
1.00	0.707	0.530	0.800	0.909
1.02	0.726	0.545	0.800	0.929
1.04	0.746	0.560	0.800	0.948
1.06	0.766	0.575	0.800	0.967
1.08	0.786	0.590	0.800	0.987
1.10	0.807	0.605	0.800	1.006

APPENDIX C

NEW EXCITER CONTROL

APPENDIX C

NEW EXCITER CONTROL

The case of constant power factor control of DSGs using synchronous generators was not included in the main text of this report because it was a special situation and did not represent a common mode of control. However, it is an interesting case from the point of view of utilities. Utilities would like to be reasonably sure that the power factor does not deteriorate and fluctuate when DSGs are interconnected into their systems. This case, therefore, was studied and the results are tabulated here. Graphical results are given at the end of Section 3.

The control strategy uses a simple exciter feedback that is obtained by amplifying an error signal which represents the difference between the output reactive power and a reference reactive power. The case of constant power factor control at unity power factor (i.e. zero reactive power) was analyzed and presented in Sections 2 and 3. Since power factor is cosine of arctangent of the ratio of reactive power to real power, the reference reactive power may be set equal to tan ϕ times power input to the machine or to tan ϕ times power output of the DSG, where ϕ is the desired power factor angle. Therefore, these two strategies give excitation equations

V1 = KG (tan ϕ. PG−QDSG)

or V1 = KG (tan ϕ. PDSG−QDSG),

Where KG is a gain constant.

The solution method proceeds as follows (Figure 2-4).

- To simulate voltage control on the distribution system, VS is varied from 0.9 to 1.1 pu.
- To simulate input power variations the value of PM, the input mechanical power. is varied from 0.02 to 0.20 pu. This represents 20% penetration.
- VT is taken as reference for the calculations. The magnitude is not known at the outset, so a guess is made to provide an initial starting point. The value of VT is then determined iteratively.
    - A value is guessed for the angle β of VS
    - Knowing the load (terminal) characteristics and VT, IL is calculated
    - Knowing VT and VS, IS is calculated
    - Knowing IL and IS, I1 is calculated

- Knowing VT, Z1, and I1, V1 is calculated
- Using VT and I1, PDSG and QDSG are calculated
- Knowing PG or PDSG and QDSG, excitation voltage V1 is calculated
- With the error between the two values of magnitude of V1, the value of VT is updated
- With the updated value of VT, all earlier calculations are repeated until the convergence criterion on voltage error is satisfied

- With known phasors VT and V1, I1 is calculated to find error between the input and calculated values of real power.
- Based on this error, the angle β is updated.
- With the updated value of β and previously obtained value of VT, earlier steps are repeated until the convergence criterion on real power error is satisfied.
- Once complete convergence is obtained, the required performance parameters are calculated and printed.

The solution method is shown in diagram form in Figure C-1.

Table C-I presents the program listing, and Table C-II the data obtained by running the program.

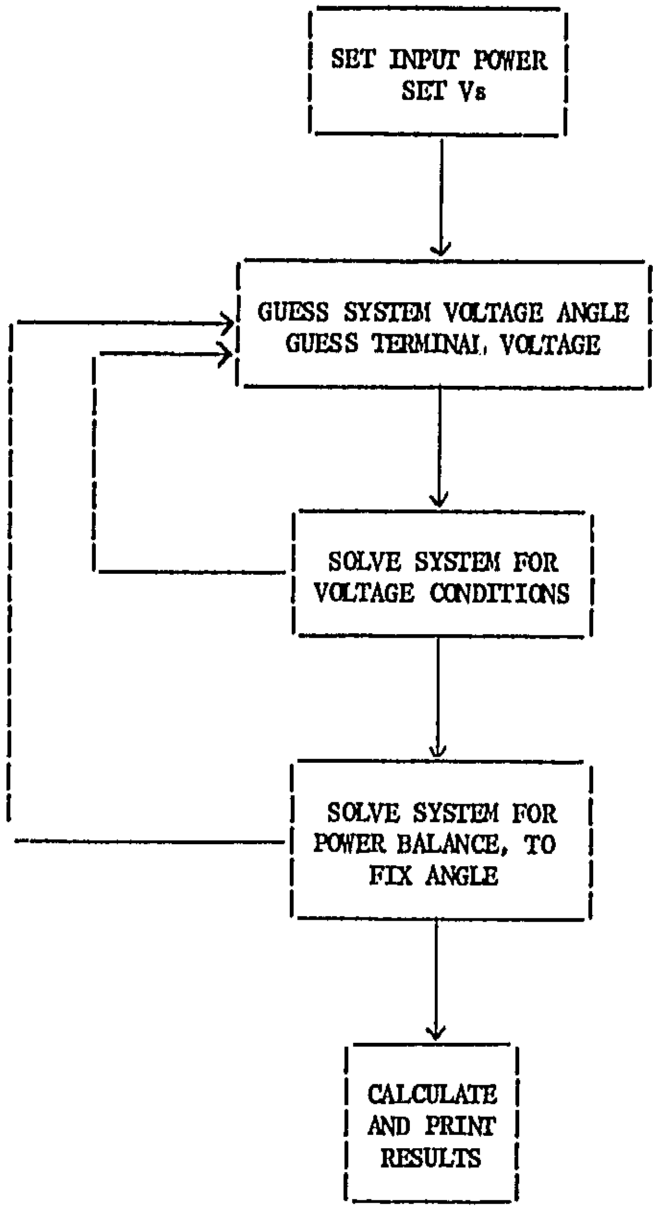

Figure C-1. Method Used to Solve the Distribution System/Synchronous Machine Problem with the Exciter Controlled for Constant Power Factor

TABLE C-I

LISTING OF CONSTANT (LEADING) POWER FACTOR PROGRAM

```
10 REM KIRKHAM'S FAMOUS VOLTAGE STUDY        FILE B:CONPF-THREE
20 REM
30 LPRINT "THIS PROGRAM CALCULATES THE CASE OF A SYNCHRONOUS GENERATOR"
40 LPRINT "                CONSTANT POWER FACTOR CONTROL"
50 REM
60 REM INITIALIZE
70 REM
80 RS      = .04
90 XS     = .1
100 R1=.1
110 X1=1
120 KG   = 100
130 QREF    = 0
140 VLIMIT  = 2.5
150 KV   = -.002
160 KB = - 5
170 REM   SET THE LOAD TYPE  (1 FOR RESISTIVE, 2 FOR MORE REALISM)
180 FOR LTYPE = 1 TO 4 STEP 1
190 IF(LTYPE=1) GOTO 225
191 IF LTYPE = 3 GOTO 225
200 LPRINT
210 LPRINT "REALISTIC LOAD REPRESENTATION"
220 GOTO 250
225 LPRINT
226 LPRINT
230 LPRINT "CONSTANT IMPEDANCE LOAD"
240 REM SET THE INPUT POWER
250 FOR PG = .02 TO .2 STEP .02
260 LPRINT
270 LPRINT
280 LPRINT "SYS V   P IN   DSG P   DSG Q  DSG PF   SYS P   SYS Q   SYS PF  LO(
V  EXCITN"
290 REM GUESS THE VALUE OF VT
300 VT   = .86
310 REM GUESS THE ANGLE OF VS...CALL IT BETA
320 BETA   = 1.447
330 REM SET THE SYSTEM VOLTAGE
340 FOR VS = .9 TO 1.1 STEP .02
350 VITER = 0
360 DITER = 0
370 DITER = DITER +1
380 VITER = VITER +1
390 REM    CALCULATE IL
400 REM   CHECK THE LOAD TYPE
410 IF (LTYPE = 1) GOTO 440
415 IF LTYPE = 3 GOTO 440
420 N     = 1.3
430 GOTO 450
440 N     = 2
```

TABLE C-I contd.

LISTING OF CONSTANT (LEADING) POWER FACTOR PROGRAM

```
450 ILR  = .08*(VT^(N-1))
460 ILI  = -.06*(VT^(N-1))
461 IF LTYPE = 3 GOTO 464
462 IF LTYPE = 4 GOTO 464
463 GOTO 470
464 ILR       = 10*ILR
465 ILI       = 10*ILI
470 REM WITH IL, VS AND BETA FIND I2
480 VSR   = VS*COS(BETA*3.14159/180)
490 VSI   = VS*SIN(BETA*3.14159/180)
500 A     = VSR-VT
510 B     = VSI
520 C     = RS
530 D     = XS
540 GOSUB 1330
550 I2R   = DIVR
560 I2I   = DIVI
570 REM
580 REM NOW FIND I1
590 REM
600 I1R   = ILR - I2R
610 I1I   = ILI - I2I
620 REM NOW WE GOT A VALUE FOR I1, CALCULATE THE VALUE OF V1
630 A     = I1R
640 B     = I1I
650 C     = R1
660 D     = X1
670 GOSUB 1330
680 Z1DRR = PRODR
690 Z1DRI = PRODI
700 V1R   = VT + Z1DRR
710 V1I   = Z1DRI
720 REM
730 REM NOW WE GOT THE VALUE OF V1:
 40 REM
 50 MAGV1= SQR(V1R^2 + V1I^2)
 60 REM
 70 REM COMPARE THE CALCULATED VALUE OF DSGQ WITH THE VALUE NEEDED ACCORDING TO
 HE CONTROLLER EQUATION, AND CORRECT IF NEEDED
 80 REM
 90 A     = VT
 00 B     = 0
 10 C     = I1R
 20 D     = -I1I
 30 GOSUB 1330
 40 DSGP = PRODR
 50 DSGQ = PRODI
 60 PRINT DSGQ,MAGV1
 70 PRINT "TERMINAL VOLTS ";VT;" AT VOLTAGE ITERATION ";VITER
 80 REM  USE THE CONTROLLER EQUATION
 85 QREF = .75*DSGP
 90 V1    = KG*(QREF-DSGQ)
```

TABLE C-I contd.

LISTING OF CONSTANT (LEADING) POWER FACTOR PROGRAM

```
910 VERR = MAGV1 - V1
920 PRINT "LINE 920   VERR IS ";VERR
930 IF ABS(VERR)<.0001 GOTO 980
940 VT   = VT + KV*VERR
945 PRINT "LINE 945       UPDATED VT IS ";VT
950 GOTO 360
960 REM
970 REM FALL THROUGH HERE WHEN VOLTAGE CONDITIONS ARE CORRECT
980 REM  TIME TO CALCULATE THE POWER BALANCE
990 PRINT "STARTING POWER BALANCE"
1000 A     = V1R
1010 B     = V1I
1020 C     = I1R
1030 D     = -I1I
1040 GOSUB 1330
1050 PIN  = PRODR
1060 PERR = PG - PIN
1070 PRINT "LINE 1070    PERR IS ";PERR
1080 IF ABS(PERR)<.0001 GOTO 1130
1090 BETA = BETA + KB*PERR
1100 GOTO 370
1110 REM  FIRST THE DSG POWER FACTOR
1120 REM
1130 DSGPF = COS(ATN(DSGQ/DSGP))
1140 PRINT "LINE 1140    BETA IS ";BETA
1150 REM
1160 REM    NOW FOR THE SYSTEM PARAMETERS
1170 A     = VT
1180 B     = 0
1190 C     = I2R
1200 D     = -I2I
1210 GOSUB 1330
1220 SYSP = PRODR
1230 SYSQ = PRODI
1240 SYSPF    = COS(ATN(SYSQ/SYSP))
1250 LPRINT USING "#.##    ";VS;
1260 LPRINT USING "#.###    ";PG;DSGP;DSGQ;DSGPF;SYSP;SYSQ;SYSPF;VT;V1
1270 NEXT VS
1280 VT    = .86
1290 NEXT PG
1300 NEXT LTYPE
1310 STOP
1320 REM
1330 REM    SUBROUTINE TO FIND COMPLEX PRODUCTS AND DO COMPLEX DIVISIONS
1340 PRODR = A * C - B * D
1350 PRODI = B * C + A * D
1360 DEN    = C*C +D*D
1370 DIVFLG = 0
1380 IF (DEN=0)GOTO 1420
1390 DIVR   = (A*C + B*D)/DEN
1400 DIVI   = (B*C - A*D)/DEN
1410 RETURN
1420 DIVFLG = 1
1430 REM CHECK DIVFLG ON DIVISIONS BY VARIABLES ONLY
1440 RETURN
```

TABLE C-II
DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.020	0.006	0.958	0.044	0.042	0.723	0.893	0.902
0.92	0.020	0.020	0.006	0.961	0.047	0.044	0.726	0.913	0.922
0.94	0.020	0.020	0.005	0.964	0.050	0.047	0.729	0.933	0.941
0.96	0.020	0.020	0.005	0.966	0.053	0.049	0.731	0.953	0.961
0.98	0.020	0.020	0.005	0.968	0.056	0.052	0.734	0.972	0.980
1.00	0.020	0.020	0.005	0.970	0.059	0.054	0.736	0.992	1.000
1.02	0.020	0.020	0.005	0.972	0.062	0.057	0.738	1.012	1.019
1.04	0.020	0.020	0.005	0.975	0.065	0.059	0.740	1.032	1.038
1.06	0.020	0.020	0.004	0.977	0.069	0.062	0.742	1.051	1.058
1.08	0.020	0.020	0.004	0.979	0.072	0.065	0.743	1.071	1.077
1.10	0.020	0.020	0.004	0.980	0.075	0.067	0.745	1.091	1.097

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.040	0.021	0.888	0.024	0.028	0.663	0.896	0.924
0.92	0.040	0.040	0.020	0.890	0.027	0.030	0.674	0.916	0.943
0.94	0.040	0.040	0.020	0.891	0.030	0.032	0.683	0.935	0.962
0.96	0.040	0.040	0.020	0.893	0.033	0.035	0.691	0.955	0.981
0.98	0.040	0.040	0.020	0.895	0.036	0.037	0.698	0.975	1.000
1.00	0.040	0.040	0.020	0.897	0.039	0.040	0.704	0.994	1.019
1.02	0.040	0.040	0.019	0.898	0.043	0.042	0.709	1.014	1.038
1.04	0.040	0.040	0.019	0.900	0.046	0.045	0.714	1.034	1.057
1.06	0.040	0.040	0.019	0.901	0.049	0.047	0.718	1.054	1.076
1.08	0.040	0.040	0.019	0.903	0.052	0.050	0.722	1.073	1.095
1.10	0.040	0.040	0.019	0.905	0.056	0.053	0.725	1.093	1.114

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.059	0.035	0.861	0.005	0.013	0.361	0.898	0.946
0.92	0.060	0.059	0.035	0.862	0.008	0.016	0.454	0.918	0.964
0.94	0.060	0.060	0.035	0.863	0.011	0.018	0.516	0.938	0.983
0.96	0.060	0.060	0.035	0.864	0.014	0.020	0.560	0.957	1.001
0.98	0.060	0.059	0.034	0.866	0.017	0.023	0.594	0.977	1.020
1.00	0.060	0.059	0.034	0.867	0.020	0.025	0.619	0.997	1.038
1.02	0.060	0.059	0.034	0.868	0.023	0.028	0.638	1.016	1.057
1.04	0.060	0.060	0.034	0.869	0.026	0.030	0.653	1.036	1.076
1.06	0.060	0.060	0.034	0.870	0.030	0.033	0.666	1.056	1.095
1.08	0.060	0.060	0.034	0.871	0.033	0.036	0.677	1.075	1.113
1.10	0.060	0.060	0.033	0.872	0.036	0.039	0.686	1.095	1.132

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.079	0.049	0.847	-.014	-.001	0.998	0.901	0.968
0.92	0.080	0.079	0.049	0.848	-.011	0.001	0.992	0.920	0.986
0.94	0.080	0.079	0.049	0.849	-.008	0.004	0.914	0.940	1.004
0.96	0.080	0.079	0.049	0.850	-.005	0.006	0.655	0.960	1.022
0.98	0.080	0.079	0.049	0.850	-.002	0.009	0.261	0.979	1.040
1.00	0.080	0.079	0.049	0.851	0.001	0.011	0.068	0.999	1.058
1.02	0.080	0.079	0.049	0.852	0.004	0.014	0.268	1.019	1.077
1.04	0.080	0.079	0.049	0.853	0.007	0.016	0.395	1.038	1.095
1.06	0.080	0.079	0.048	0.854	0.010	0.019	0.480	1.058	1.113
1.08	0.080	0.079	0.048	0.855	0.014	0.022	0.536	1.077	1.132
1.10	0.080	0.079	0.048	0.856	0.017	0.024	0.573	1.097	1.150

TABLE C-II contd.

DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.098	0.064	0.839	-.033	-.015	0.912	0.903	0.990
0.92	0.100	0.098	0.064	0.839	-.030	-.013	0.923	0.923	1.007
0.94	0.100	0.098	0.064	0.840	-.027	-.010	0.936	0.942	1.025
0.96	0.100	0.098	0.063	0.841	-.024	-.008	0.951	0.962	1.043
0.98	0.100	0.099	0.063	0.841	-.021	-.005	0.969	0.981	1.060
1.00	0.100	0.099	0.063	0.842	-.018	-.003	0.986	1.001	1.078
1.02	0.100	0.099	0.063	0.843	-.015	-.001	0.999	1.021	1.096
1.04	0.100	0.099	0.063	0.843	-.012	0.002	0.986	1.040	1.114
1.06	0.100	0.099	0.063	0.844	-.009	0.005	0.883	1.060	1.132
1.08	0.100	0.099	0.063	0.845	-.006	0.007	0.615	1.080	1.150
1.10	0.100	0.099	0.062	0.845	-.002	0.010	0.208	1.099	1.168

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.117	0.078	0.833	-.052	-.029	0.874	0.905	1.012
0.92	0.120	0.118	0.078	0.834	-.049	-.027	0.879	0.925	1.029
0.94	0.120	0.118	0.078	0.834	-.046	-.024	0.886	0.945	1.046
0.96	0.120	0.118	0.078	0.835	-.043	-.022	0.893	0.964	1.063
0.98	0.120	0.118	0.078	0.835	-.041	-.020	0.900	0.984	1.080
1.00	0.120	0.118	0.078	0.836	-.038	-.017	0.909	1.003	1.098
1.02	0.120	0.118	0.077	0.836	-.034	-.015	0.920	1.023	1.115
1.04	0.120	0.118	0.077	0.837	-.031	-.012	0.933	1.042	1.133
1.06	0.120	0.118	0.077	0.837	-.028	-.010	0.947	1.062	1.151
1.08	0.120	0.118	0.077	0.838	-.025	-.007	0.964	1.082	1.168
1.10	0.120	0.118	0.077	0.839	-.021	-.004	0.981	1.101	1.186

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.137	0.092	0.829	-.071	-.043	0.856	0.908	1.034
0.92	0.140	0.137	0.092	0.830	-.068	-.041	0.859	0.927	1.050
0.94	0.140	0.137	0.092	0.830	-.065	-.038	0.863	0.947	1.067
0.96	0.140	0.137	0.092	0.830	-.062	-.036	0.866	0.966	1.084
0.98	0.140	0.137	0.092	0.831	-.059	-.034	0.871	0.986	1.101
1.00	0.140	0.137	0.092	0.831	-.057	-.031	0.875	1.005	1.118
1.02	0.140	0.137	0.092	0.832	-.053	-.029	0.881	1.025	1.135
1.04	0.140	0.137	0.092	0.832	-.050	-.026	0.887	1.044	1.152
1.06	0.140	0.138	0.092	0.833	-.047	-.024	0.894	1.064	1.169
1.08	0.140	0.138	0.091	0.833	-.044	-.021	0.902	1.084	1.186
1.10	0.140	0.138	0.091	0.834	-.040	-.018	0.911	1.103	1.204

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.156	0.106	0.826	-.089	-.057	0.845	0.910	1.056
0.92	0.160	0.156	0.106	0.826	-.087	-.054	0.847	0.930	1.072
0.94	0.160	0.156	0.106	0.827	-.084	-.052	0.850	0.949	1.088
0.96	0.160	0.156	0.106	0.827	-.081	-.050	0.852	0.968	1.104
0.98	0.160	0.156	0.106	0.828	-.078	-.048	0.855	0.988	1.121
1.00	0.160	0.157	0.106	0.828	-.075	-.045	0.858	1.007	1.138
1.02	0.160	0.157	0.106	0.828	-.072	-.043	0.861	1.027	1.154
1.04	0.160	0.157	0.106	0.829	-.069	-.040	0.865	1.046	1.171
1.06	0.160	0.157	0.106	0.829	-.066	-.038	0.869	1.066	1.188
1.08	0.160	0.157	0.106	0.830	-.063	-.035	0.873	1.086	1.205
1.10	0.160	0.157	0.106	0.830	-.059	-.032	0.878	1.105	1.222

TABLE C-II contd.
DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.175	0.120	0.824	-.108	-.070	0.838	0.912	1.078
0.92	0.180	0.175	0.120	0.824	-.105	-.068	0.840	0.932	1.094
0.94	0.180	0.175	0.120	0.824	-.103	-.066	0.842	0.951	1.109
0.96	0.180	0.175	0.120	0.825	-.100	-.064	0.843	0.971	1.125
0.98	0.180	0.175	0.120	0.825	-.097	-.061	0.845	0.990	1.141
1.00	0.180	0.176	0.120	0.825	-.094	-.059	0.847	1.010	1.157
1.02	0.180	0.176	0.120	0.826	-.091	-.056	0.850	1.029	1.173
1.04	0.180	0.176	0.120	0.826	-.088	-.054	0.852	1.048	1.190
1.06	0.180	0.176	0.120	0.826	-.085	-.051	0.855	1.068	1.206
1.08	0.180	0.176	0.120	0.827	-.082	-.049	0.857	1.087	1.223
1.10	0.180	0.176	0.120	0.827	-.078	-.046	0.861	1.107	1.240

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.193	0.134	0.822	-.126	-.084	0.833	0.915	1.100
0.92	0.200	0.194	0.134	0.822	-.124	-.082	0.835	0.934	1.115
0.94	0.200	0.194	0.134	0.822	-.121	-.080	0.836	0.953	1.130
0.96	0.200	0.194	0.134	0.823	-.118	-.077	0.837	0.973	1.146
0.98	0.200	0.194	0.134	0.823	-.116	-.075	0.839	0.992	1.162
1.00	0.200	0.194	0.134	0.823	-.113	-.073	0.840	1.012	1.177
1.02	0.200	0.195	0.134	0.824	-.110	-.070	0.842	1.031	1.193
1.04	0.200	0.195	0.134	0.824	-.107	-.068	0.844	1.051	1.209
1.06	0.200	0.195	0.134	0.824	-.103	-.065	0.846	1.070	1.225
1.08	0.200	0.195	0.134	0.824	-.100	-.063	0.847	1.089	1.242
1.10	0.200	0.196	0.134	0.825	-.097	-.060	0.850	1.109	1.258

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.020	0.006	0.958	0.049	0.046	0.731	0.893	0.902
0.92	0.020	0.020	0.006	0.961	0.051	0.048	0.732	0.913	0.921
0.94	0.020	0.020	0.006	0.963	0.053	0.049	0.733	0.932	0.941
0.96	0.020	0.020	0.005	0.966	0.055	0.051	0.734	0.952	0.960
0.98	0.020	0.020	0.005	0.968	0.057	0.053	0.735	0.972	0.980
1.00	0.020	0.020	0.005	0.970	0.059	0.054	0.736	0.992	0.999
1.02	0.020	0.020	0.005	0.972	0.061	0.056	0.737	1.012	1.019
1.04	0.020	0.020	0.005	0.974	0.063	0.058	0.738	1.032	1.038
1.06	0.020	0.020	0.004	0.976	0.065	0.060	0.739	1.052	1.058
1.08	0.020	0.020	0.004	0.978	0.067	0.061	0.740	1.072	1.078
1.10	0.020	0.020	0.004	0.981	0.070	0.063	0.741	1.092	1.097

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.040	0.021	0.888	0.030	0.031	0.685	0.895	0.924
0.92	0.040	0.040	0.020	0.890	0.032	0.033	0.690	0.915	0.942
0.94	0.040	0.040	0.020	0.892	0.034	0.035	0.694	0.935	0.961
0.96	0.040	0.040	0.020	0.893	0.036	0.036	0.698	0.955	0.981
0.98	0.040	0.040	0.020	0.895	0.038	0.038	0.701	0.975	1.000
1.00	0.040	0.040	0.020	0.896	0.040	0.040	0.704	0.994	1.019
1.02	0.040	0.040	0.020	0.898	0.042	0.042	0.707	1.014	1.038
1.04	0.040	0.040	0.019	0.900	0.044	0.043	0.710	1.034	1.057
1.06	0.040	0.040	0.019	0.902	0.046	0.045	0.713	1.054	1.076
1.08	0.040	0.040	0.019	0.903	0.048	0.047	0.715	1.074	1.096
1.10	0.040	0.040	0.019	0.905	0.050	0.049	0.717	1.094	1.115

TABLE C-II contd.
DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.059	0.035	0.861	0.010	0.017	0.511	0.898	0.945
0.92	0.060	0.059	0.035	0.862	0.012	0.019	0.543	0.917	0.964
0.94	0.060	0.059	0.035	0.863	0.014	0.020	0.568	0.937	0.982
0.96	0.060	0.060	0.035	0.864	0.016	0.022	0.588	0.957	1.001
0.98	0.060	0.060	0.034	0.865	0.018	0.024	0.605	0.977	1.020
1.00	0.060	0.059	0.034	0.867	0.020	0.025	0.620	0.997	1.038
1.02	0.060	0.060	0.034	0.868	0.022	0.027	0.632	1.016	1.057
1.04	0.060	0.059	0.034	0.869	0.024	0.029	0.642	1.036	1.076
1.06	0.060	0.059	0.034	0.870	0.026	0.031	0.651	1.056	1.095
1.08	0.060	0.060	0.034	0.871	0.028	0.032	0.658	1.076	1.114
1.10	0.060	0.060	0.033	0.872	0.030	0.034	0.665	1.096	1.133

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.079	0.049	0.847	-.009	0.003	0.955	0.900	0.967
0.92	0.080	0.079	0.049	0.848	-.007	0.004	0.853	0.920	0.985
0.94	0.080	0.079	0.049	0.849	-.005	0.006	0.657	0.940	1.003
0.96	0.080	0.079	0.049	0.850	-.003	0.008	0.398	0.959	1.022
0.98	0.080	0.079	0.049	0.850	-.001	0.009	0.129	0.979	1.040
1.00	0.080	0.079	0.049	0.851	0.001	0.011	0.071	0.999	1.058
1.02	0.080	0.079	0.049	0.852	0.003	0.013	0.216	1.019	1.077
1.04	0.080	0.079	0.048	0.853	0.005	0.015	0.312	1.038	1.095
1.06	0.080	0.079	0.048	0.854	0.007	0.016	0.386	1.058	1.114
1.08	0.080	0.079	0.048	0.855	0.009	0.018	0.446	1.078	1.132
1.10	0.080	0.079	0.048	0.856	0.011	0.020	0.489	1.098	1.151

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.098	0.064	0.839	-.028	-.011	0.929	0.902	0.989
0.92	0.100	0.098	0.064	0.839	-.026	-.010	0.938	0.922	1.007
0.94	0.100	0.099	0.064	0.840	-.025	-.008	0.949	0.942	1.025
0.96	0.100	0.098	0.063	0.841	-.022	-.006	0.961	0.962	1.042
0.98	0.100	0.099	0.063	0.841	-.020	-.005	0.974	0.981	1.060
1.00	0.100	0.099	0.063	0.842	-.018	-.003	0.987	1.001	1.078
1.02	0.100	0.099	0.063	0.843	-.017	-.001	0.996	1.021	1.096
1.04	0.100	0.099	0.063	0.843	-.015	0.000	1.000	1.041	1.114
1.06	0.100	0.099	0.063	0.844	-.012	0.002	0.987	1.060	1.132
1.08	0.100	0.099	0.063	0.845	-.010	0.004	0.939	1.080	1.150
1.10	0.100	0.099	0.063	0.845	-.008	0.005	0.842	1.100	1.169

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.117	0.078	0.833	-.047	-.025	0.881	0.905	1.011
0.92	0.120	0.118	0.078	0.834	-.045	-.024	0.886	0.925	1.028
0.94	0.120	0.118	0.078	0.834	-.043	-.022	0.891	0.944	1.046
0.96	0.120	0.118	0.078	0.835	-.042	-.021	0.896	0.964	1.063
0.98	0.120	0.118	0.078	0.835	-.040	-.019	0.903	0.984	1.080
1.00	0.120	0.118	0.078	0.836	-.038	-.017	0.909	1.003	1.098
1.02	0.120	0.118	0.077	0.836	-.036	-.016	0.916	1.023	1.115
1.04	0.120	0.118	0.077	0.837	-.034	-.014	0.924	1.043	1.133
1.06	0.120	0.118	0.077	0.837	-.032	-.012	0.933	1.062	1.151
1.08	0.120	0.118	0.077	0.838	-.030	-.011	0.942	1.082	1.169
1.10	0.120	0.118	0.077	0.839	-.028	-.009	0.953	1.102	1.186

TABLE C-II contd.
DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.137	0.092	0.829	-.066	-.039	0.860	0.907	1.033
0.92	0.140	0.137	0.092	0.830	-.064	-.038	0.862	0.927	1.050
0.94	0.140	0.137	0.092	0.830	-.062	-.036	0.865	0.946	1.067
0.96	0.140	0.137	0.092	0.830	-.061	-.035	0.868	0.966	1.084
0.98	0.140	0.137	0.092	0.831	-.059	-.033	0.872	0.986	1.100
1.00	0.140	0.137	0.092	0.831	-.057	-.031	0.875	1.005	1.118
1.02	0.140	0.137	0.092	0.832	-.055	-.030	0.879	1.025	1.135
1.04	0.140	0.137	0.092	0.832	-.053	-.028	0.883	1.045	1.152
1.06	0.140	0.138	0.092	0.833	-.051	-.026	0.887	1.064	1.170
1.08	0.140	0.138	0.091	0.833	-.049	-.025	0.892	1.084	1.187
1.10	0.140	0.138	0.091	0.834	-.047	-.023	0.897	1.104	1.205

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.156	0.106	0.826	-.085	-.053	0.848	0.910	1.056
0.92	0.160	0.156	0.106	0.826	-.083	-.052	0.849	0.929	1.072
0.94	0.160	0.156	0.106	0.827	-.081	-.050	0.851	0.949	1.088
0.96	0.160	0.156	0.106	0.827	-.079	-.049	0.853	0.968	1.104
0.98	0.160	0.156	0.106	0.828	-.078	-.047	0.855	0.988	1.121
1.00	0.160	0.157	0.106	0.828	-.076	-.045	0.858	1.008	1.138
1.02	0.160	0.157	0.106	0.828	-.074	-.044	0.860	1.027	1.154
1.04	0.160	0.157	0.106	0.829	-.072	-.042	0.862	1.047	1.171
1.06	0.160	0.157	0.106	0.829	-.070	-.041	0.865	1.066	1.188
1.08	0.160	0.157	0.106	0.830	-.068	-.039	0.868	1.086	1.205
1.10	0.160	0.157	0.106	0.830	-.066	-.037	0.871	1.106	1.223

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.175	0.120	0.824	-.104	-.067	0.840	0.912	1.078
0.92	0.180	0.175	0.120	0.824	-.102	-.065	0.841	0.931	1.093
0.94	0.180	0.175	0.120	0.824	-.100	-.064	0.843	0.951	1.109
0.96	0.180	0.175	0.120	0.825	-.098	-.062	0.844	0.970	1.125
0.98	0.180	0.175	0.120	0.825	-.096	-.061	0.845	0.990	1.141
1.00	0.180	0.176	0.120	0.825	-.095	-.059	0.847	1.010	1.158
1.02	0.180	0.176	0.120	0.826	-.093	-.058	0.849	1.029	1.174
1.04	0.180	0.176	0.120	0.826	-.091	-.056	0.850	1.049	1.190
1.06	0.180	0.176	0.120	0.826	-.089	-.055	0.852	1.068	1.207
1.08	0.180	0.176	0.120	0.827	-.087	-.053	0.854	1.088	1.224
1.10	0.180	0.176	0.120	0.827	-.085	-.051	0.856	1.108	1.241

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.193	0.134	0.822	-.122	-.081	0.835	0.914	1.100
0.92	0.200	0.194	0.134	0.822	-.120	-.079	0.836	0.934	1.115
0.94	0.200	0.194	0.134	0.822	-.119	-.078	0.837	0.953	1.130
0.96	0.200	0.194	0.134	0.823	-.117	-.076	0.838	0.973	1.146
0.98	0.200	0.194	0.134	0.823	-.115	-.075	0.839	0.992	1.161
1.00	0.200	0.195	0.134	0.823	-.113	-.073	0.840	1.012	1.177
1.02	0.200	0.195	0.134	0.824	-.111	-.072	0.841	1.031	1.193
1.04	0.200	0.195	0.134	0.824	-.110	-.070	0.842	1.051	1.209
1.06	0.200	0.195	0.134	0.824	-.108	-.068	0.844	1.070	1.226
1.08	0.200	0.195	0.134	0.824	-.106	-.067	0.845	1.090	1.242
1.10	0.200	0.195	0.134	0.825	-.104	-.065	0.847	1.110	1.259

TABLE C-II contd.
DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

CONSTANT IMPEDANCE LOAD

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.020	0.007	0.949	0.524	0.402	0.794	0.825	0.836
0.92	0.020	0.020	0.006	0.952	0.549	0.420	0.794	0.843	0.853
0.94	0.020	0.020	0.006	0.955	0.574	0.439	0.794	0.861	0.871
0.96	0.020	0.020	0.006	0.957	0.599	0.458	0.794	0.880	0.889
0.98	0.020	0.020	0.006	0.959	0.625	0.478	0.794	0.898	0.907
1.00	0.020	0.020	0.006	0.961	0.651	0.498	0.795	0.916	0.925
1.02	0.020	0.020	0.006	0.963	0.678	0.518	0.795	0.934	0.943
1.04	0.020	0.020	0.005	0.966	0.706	0.539	0.795	0.952	0.960
1.06	0.020	0.020	0.005	0.968	0.734	0.560	0.795	0.971	0.978
1.08	0.020	0.020	0.005	0.970	0.763	0.582	0.795	0.989	0.996
1.10	0.020	0.020	0.005	0.972	0.792	0.604	0.795	1.007	1.014

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.040	0.021	0.882	0.508	0.390	0.794	0.827	0.859
0.92	0.040	0.040	0.021	0.884	0.532	0.408	0.794	0.846	0.876
0.94	0.040	0.040	0.021	0.885	0.557	0.427	0.794	0.864	0.894
0.96	0.040	0.040	0.021	0.887	0.582	0.446	0.794	0.882	0.911
0.98	0.040	0.040	0.021	0.888	0.608	0.466	0.794	0.900	0.928
1.00	0.040	0.040	0.020	0.890	0.635	0.486	0.794	0.918	0.946
1.02	0.040	0.040	0.020	0.892	0.662	0.506	0.794	0.937	0.963
1.04	0.040	0.040	0.020	0.893	0.689	0.527	0.795	0.955	0.981
1.06	0.040	0.040	0.020	0.895	0.717	0.548	0.795	0.973	0.998
1.08	0.040	0.040	0.020	0.896	0.746	0.570	0.795	0.991	1.016
1.10	0.040	0.040	0.019	0.898	0.775	0.592	0.795	1.009	1.033

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.059	0.036	0.857	0.492	0.378	0.793	0.830	0.882
0.92	0.060	0.059	0.036	0.858	0.516	0.396	0.793	0.848	0.899
0.94	0.060	0.059	0.035	0.859	0.541	0.415	0.794	0.866	0.916
0.96	0.060	0.059	0.035	0.860	0.566	0.434	0.794	0.884	0.933
0.98	0.060	0.059	0.035	0.861	0.592	0.454	0.794	0.902	0.950
1.00	0.060	0.059	0.035	0.862	0.619	0.474	0.794	0.921	0.967
1.02	0.060	0.059	0.035	0.863	0.646	0.494	0.794	0.939	0.984
1.04	0.060	0.060	0.035	0.864	0.673	0.515	0.794	0.957	1.001
1.06	0.060	0.060	0.035	0.865	0.701	0.536	0.794	0.975	1.018
1.08	0.060	0.059	0.034	0.867	0.730	0.558	0.795	0.993	1.035
1.10	0.060	0.060	0.034	0.868	0.759	0.580	0.795	1.011	1.053

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.079	0.050	0.844	0.476	0.366	0.793	0.832	0.906
0.92	0.080	0.079	0.050	0.845	0.500	0.384	0.793	0.850	0.923
0.94	0.080	0.079	0.050	0.846	0.525	0.403	0.793	0.869	0.939
0.96	0.080	0.079	0.050	0.847	0.550	0.422	0.793	0.887	0.955
0.98	0.080	0.079	0.049	0.847	0.576	0.442	0.794	0.905	0.972
1.00	0.080	0.079	0.049	0.848	0.602	0.462	0.794	0.923	0.988
1.02	0.080	0.079	0.049	0.849	0.629	0.482	0.794	0.941	1.005
1.04	0.080	0.079	0.049	0.850	0.657	0.503	0.794	0.959	1.022
1.06	0.080	0.079	0.049	0.850	0.685	0.524	0.794	0.977	1.038
1.08	0.080	0.079	0.049	0.851	0.714	0.546	0.794	0.995	1.055
1.10	0.080	0.079	0.049	0.852	0.743	0.568	0.794	1.014	1.072

TABLE C-II contd.

DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.098	0.064	0.836	0.459	0.354	0.792	0.835	0.930
0.92	0.100	0.098	0.064	0.837	0.484	0.372	0.793	0.853	0.946
0.94	0.100	0.098	0.064	0.838	0.509	0.391	0.793	0.871	0.961
0.96	0.100	0.098	0.064	0.838	0.534	0.410	0.793	0.889	0.977
0.98	0.100	0.098	0.064	0.839	0.560	0.430	0.793	0.907	0.993
1.00	0.100	0.098	0.064	0.839	0.586	0.450	0.793	0.925	1.009
1.02	0.100	0.099	0.064	0.840	0.613	0.470	0.794	0.943	1.026
1.04	0.100	0.098	0.063	0.841	0.641	0.491	0.794	0.961	1.042
1.06	0.100	0.098	0.063	0.841	0.669	0.512	0.794	0.979	1.058
1.08	0.100	0.099	0.063	0.842	0.697	0.534	0.794	0.997	1.075
1.10	0.100	0.099	0.063	0.843	0.726	0.556	0.794	1.016	1.091
SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.117	0.078	0.831	0.444	0.342	0.792	0.837	0.954
0.92	0.120	0.117	0.078	0.832	0.468	0.361	0.792	0.855	0.969
0.94	0.120	0.117	0.078	0.832	0.493	0.379	0.792	0.873	0.984
0.96	0.120	0.117	0.078	0.833	0.518	0.398	0.793	0.891	1.000
0.98	0.120	0.118	0.078	0.833	0.544	0.418	0.793	0.909	1.015
1.00	0.120	0.118	0.078	0.834	0.570	0.438	0.793	0.927	1.031
1.02	0.120	0.118	0.078	0.834	0.597	0.458	0.793	0.945	1.047
1.04	0.120	0.118	0.078	0.835	0.625	0.479	0.793	0.963	1.063
1.06	0.120	0.118	0.078	0.835	0.653	0.500	0.794	0.981	1.078
1.08	0.120	0.118	0.078	0.836	0.681	0.522	0.794	0.999	1.094
1.10	0.120	0.118	0.077	0.836	0.710	0.544	0.794	1.018	1.111
SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.136	0.092	0.828	0.428	0.331	0.791	0.840	0.978
0.92	0.140	0.136	0.092	0.828	0.452	0.349	0.792	0.858	0.992
0.94	0.140	0.136	0.092	0.828	0.477	0.368	0.792	0.875	1.007
0.96	0.140	0.137	0.092	0.829	0.502	0.387	0.792	0.893	1.022
0.98	0.140	0.137	0.092	0.829	0.528	0.406	0.792	0.911	1.037
1.00	0.140	0.137	0.092	0.830	0.554	0.426	0.793	0.929	1.052
1.02	0.140	0.137	0.092	0.830	0.581	0.447	0.793	0.947	1.068
1.04	0.140	0.137	0.092	0.830	0.609	0.467	0.793	0.965	1.083
1.06	0.140	0.137	0.092	0.831	0.637	0.488	0.793	0.984	1.099
1.08	0.140	0.137	0.092	0.831	0.665	0.510	0.794	1.002	1.114
1.10	0.140	0.137	0.092	0.832	0.694	0.532	0.794	1.020	1.130
SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.155	0.106	0.825	0.412	0.319	0.791	0.842	1.001
0.92	0.160	0.155	0.106	0.825	0.436	0.337	0.791	0.860	1.015
0.94	0.160	0.155	0.106	0.825	0.461	0.356	0.791	0.878	1.030
0.96	0.160	0.156	0.106	0.826	0.486	0.375	0.792	0.896	1.044
0.98	0.160	0.156	0.106	0.826	0.512	0.395	0.792	0.914	1.059
1.00	0.160	0.156	0.106	0.826	0.538	0.415	0.792	0.932	1.074
1.02	0.160	0.156	0.106	0.827	0.565	0.435	0.793	0.950	1.089
1.04	0.160	0.156	0.106	0.827	0.593	0.456	0.793	0.968	1.104
1.06	0.160	0.156	0.106	0.828	0.621	0.477	0.793	0.986	1.119
1.08	0.160	0.157	0.106	0.828	0.649	0.498	0.793	1.004	1.134
1.10	0.160	0.157	0.106	0.828	0.678	0.520	0.794	1.022	1.149

DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.174	0.120	0.823	0.396	0.308	0.790	0.844	1.025
0.92	0.180	0.174	0.120	0.823	0.421	0.326	0.791	0.862	1.039
0.94	0.180	0.174	0.120	0.823	0.445	0.345	0.791	0.880	1.052
0.96	0.180	0.174	0.120	0.824	0.470	0.364	0.791	0.898	1.067
0.98	0.180	0.175	0.120	0.824	0.496	0.383	0.792	0.916	1.081
1.00	0.180	0.175	0.120	0.824	0.523	0.403	0.792	0.934	1.095
1.02	0.180	0.175	0.120	0.824	0.550	0.423	0.792	0.952	1.110
1.04	0.180	0.175	0.120	0.825	0.577	0.444	0.793	0.970	1.124
1.06	0.180	0.175	0.120	0.825	0.605	0.465	0.793	0.988	1.139
1.08	0.180	0.176	0.120	0.825	0.633	0.487	0.793	1.006	1.154
1.10	0.180	0.176	0.120	0.826	0.662	0.508	0.793	1.024	1.169

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.192	0.134	0.821	0.381	0.296	0.789	0.846	1.049
0.92	0.200	0.193	0.134	0.821	0.405	0.314	0.790	0.864	1.062
0.94	0.200	0.193	0.134	0.821	0.430	0.333	0.790	0.882	1.075
0.96	0.200	0.193	0.134	0.822	0.455	0.352	0.791	0.900	1.089
0.98	0.200	0.193	0.134	0.822	0.481	0.372	0.791	0.918	1.103
1.00	0.200	0.194	0.134	0.822	0.507	0.391	0.792	0.936	1.116
1.02	0.200	0.194	0.134	0.822	0.534	0.412	0.792	0.954	1.131
1.04	0.200	0.194	0.134	0.823	0.561	0.432	0.792	0.972	1.145
1.06	0.200	0.194	0.134	0.823	0.589	0.453	0.792	0.990	1.159
1.08	0.200	0.194	0.134	0.823	0.618	0.475	0.793	1.008	1.174
1.10	0.200	0.195	0.134	0.823	0.647	0.497	0.793	1.025	1.189

REALISTIC LOAD REPRESENTATION

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.020	0.020	0.007	0.948	0.592	0.452	0.795	0.814	0.825
0.92	0.020	0.020	0.007	0.951	0.611	0.467	0.795	0.833	0.844
0.94	0.020	0.020	0.006	0.953	0.630	0.481	0.795	0.853	0.863
0.96	0.020	0.020	0.006	0.956	0.650	0.496	0.795	0.872	0.881
0.98	0.020	0.020	0.006	0.958	0.669	0.511	0.795	0.891	0.900
1.00	0.020	0.020	0.006	0.960	0.688	0.525	0.795	0.911	0.919
1.02	0.020	0.020	0.006	0.962	0.708	0.540	0.795	0.930	0.938
1.04	0.020	0.020	0.005	0.966	0.728	0.556	0.795	0.949	0.957
1.06	0.020	0.020	0.005	0.968	0.748	0.571	0.795	0.969	0.976
1.08	0.020	0.020	0.005	0.970	0.768	0.586	0.795	0.988	0.996
1.10	0.020	0.020	0.005	0.972	0.788	0.601	0.795	1.008	1.015

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.040	0.040	0.021	0.881	0.575	0.440	0.794	0.817	0.849
0.92	0.040	0.040	0.021	0.883	0.594	0.454	0.794	0.836	0.867
0.94	0.040	0.040	0.021	0.885	0.613	0.469	0.794	0.855	0.885
0.96	0.040	0.040	0.021	0.886	0.632	0.483	0.795	0.874	0.904
0.98	0.040	0.040	0.021	0.888	0.652	0.498	0.795	0.894	0.922
1.00	0.040	0.040	0.020	0.890	0.671	0.513	0.795	0.913	0.941
1.02	0.040	0.040	0.020	0.891	0.691	0.528	0.795	0.932	0.959
1.04	0.040	0.040	0.020	0.893	0.711	0.543	0.795	0.952	0.978
1.06	0.040	0.040	0.020	0.895	0.730	0.558	0.795	0.971	0.996
1.08	0.040	0.040	0.020	0.896	0.750	0.573	0.795	0.991	1.015
1.10	0.040	0.040	0.019	0.898	0.771	0.588	0.795	1.010	1.034

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OF POOR QUALITY

TABLE C-II contd.
DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.060	0.059	0.036	0.856	0.558	0.427	0.794	0.819	0.873
0.92	0.060	0.059	0.036	0.858	0.577	0.442	0.794	0.839	0.891
0.94	0.060	0.059	0.035	0.859	0.596	0.456	0.794	0.858	0.908
0.96	0.060	0.059	0.035	0.860	0.615	0.471	0.794	0.877	0.926
0.98	0.060	0.059	0.035	0.861	0.634	0.485	0.794	0.896	0.944
1.00	0.060	0.059	0.035	0.862	0.654	0.500	0.794	0.916	0.962
1.02	0.060	0.059	0.035	0.863	0.674	0.515	0.794	0.935	0.980
1.04	0.060	0.059	0.035	0.864	0.693	0.530	0.794	0.954	0.998
1.06	0.060	0.060	0.034	0.865	0.713	0.545	0.795	0.974	1.017
1.08	0.060	0.060	0.034	0.866	0.733	0.560	0.795	0.993	1.035
1.10	0.060	0.059	0.034	0.868	0.753	0.575	0.795	1.012	1.053

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.080	0.079	0.050	0.844	0.541	0.415	0.794	0.822	0.897
0.92	0.080	0.079	0.050	0.845	0.560	0.429	0.794	0.841	0.914
0.94	0.080	0.079	0.050	0.845	0.579	0.444	0.794	0.860	0.931
0.96	0.080	0.079	0.050	0.846	0.598	0.458	0.794	0.880	0.949
0.98	0.080	0.079	0.050	0.847	0.617	0.473	0.794	0.899	0.966
1.00	0.080	0.079	0.049	0.848	0.637	0.487	0.794	0.918	0.984
1.02	0.080	0.079	0.049	0.849	0.656	0.502	0.794	0.937	1.001
1.04	0.080	0.079	0.049	0.850	0.676	0.517	0.794	0.956	1.019
1.06	0.080	0.079	0.049	0.850	0.696	0.532	0.794	0.976	1.037
1.08	0.080	0.079	0.049	0.851	0.716	0.547	0.794	0.995	1.055
1.10	0.080	0.079	0.049	0.852	0.736	0.563	0.794	1.014	1.073

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.100	0.098	0.064	0.836	0.525	0.403	0.793	0.825	0.921
0.92	0.100	0.098	0.064	0.837	0.543	0.417	0.793	0.844	0.938
0.94	0.100	0.098	0.064	0.837	0.562	0.431	0.793	0.863	0.954
0.96	0.100	0.098	0.064	0.838	0.581	0.446	0.794	0.882	0.971
0.98	0.100	0.098	0.064	0.839	0.600	0.460	0.794	0.901	0.988
1.00	0.100	0.098	0.064	0.839	0.620	0.475	0.794	0.920	1.005
1.02	0.100	0.098	0.064	0.840	0.639	0.490	0.794	0.940	1.022
1.04	0.100	0.098	0.063	0.841	0.659	0.505	0.794	0.959	1.040
1.06	0.100	0.099	0.063	0.841	0.679	0.520	0.794	0.978	1.057
1.08	0.100	0.099	0.063	0.842	0.698	0.535	0.794	0.997	1.075
1.10	0.100	0.099	0.063	0.843	0.719	0.550	0.794	1.017	1.092

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.120	0.117	0.078	0.831	0.508	0.391	0.793	0.827	0.945
0.92	0.120	0.117	0.078	0.832	0.527	0.405	0.793	0.846	0.961
0.94	0.120	0.117	0.078	0.832	0.546	0.419	0.793	0.865	0.977
0.96	0.120	0.117	0.078	0.833	0.565	0.433	0.793	0.884	0.994
0.98	0.120	0.118	0.078	0.833	0.584	0.448	0.793	0.904	1.010
1.00	0.120	0.118	0.078	0.834	0.603	0.462	0.793	0.923	1.027
1.02	0.120	0.118	0.078	0.834	0.622	0.477	0.794	0.942	1.044
1.04	0.120	0.118	0.078	0.835	0.642	0.492	0.794	0.961	1.060
1.06	0.120	0.118	0.078	0.835	0.662	0.507	0.794	0.980	1.077
1.08	0.120	0.118	0.078	0.836	0.681	0.522	0.794	0.999	1.094
1.10	0.120	0.118	0.077	0.836	0.701	0.537	0.794	1.019	1.111

TABLE C-II contd.
DATA FOR CONSTANT (LEADING) POWER FACTOR CASE

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.140	0.136	0.092	0.827	0.492	0.378	0.792	0.830	0.970
0.92	0.140	0.136	0.092	0.828	0.510	0.393	0.793	0.849	0.985
0.94	0.140	0.136	0.092	0.828	0.529	0.407	0.793	0.868	1.001
0.96	0.140	0.137	0.092	0.829	0.548	0.421	0.793	0.887	1.017
0.98	0.140	0.137	0.092	0.829	0.567	0.435	0.793	0.906	1.032
1.00	0.140	0.137	0.092	0.829	0.586	0.450	0.793	0.925	1.049
1.02	0.140	0.137	0.092	0.830	0.606	0.465	0.793	0.944	1.065
1.04	0.140	0.137	0.092	0.830	0.625	0.480	0.793	0.963	1.081
1.06	0.140	0.137	0.092	0.831	0.645	0.494	0.793	0.982	1.098
1.08	0.140	0.137	0.092	0.831	0.664	0.509	0.794	1.002	1.114
1.10	0.140	0.137	0.092	0.832	0.684	0.525	0.794	1.021	1.131

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.160	0.155	0.106	0.825	0.475	0.366	0.792	0.832	0.994
0.92	0.160	0.155	0.106	0.825	0.494	0.380	0.792	0.851	1.009
0.94	0.160	0.155	0.106	0.825	0.512	0.395	0.792	0.870	1.024
0.96	0.160	0.156	0.106	0.826	0.531	0.409	0.792	0.889	1.039
0.98	0.160	0.156	0.106	0.826	0.550	0.423	0.793	0.908	1.055
1.00	0.160	0.156	0.106	0.826	0.569	0.438	0.793	0.927	1.070
1.02	0.160	0.156	0.106	0.827	0.589	0.452	0.793	0.946	1.086
1.04	0.160	0.156	0.106	0.827	0.608	0.467	0.793	0.965	1.102
1.06	0.160	0.156	0.106	0.828	0.628	0.482	0.793	0.985	1.118
1.08	0.160	0.156	0.106	0.828	0.648	0.497	0.793	1.004	1.134
1.10	0.160	0.157	0.106	0.828	0.667	0.512	0.793	1.023	1.151

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.180	0.174	0.120	0.823	0.459	0.354	0.791	0.835	1.018
0.92	0.180	0.174	0.120	0.823	0.477	0.368	0.792	0.854	1.032
0.94	0.180	0.174	0.120	0.823	0.496	0.383	0.792	0.873	1.047
0.96	0.180	0.174	0.120	0.823	0.515	0.397	0.792	0.892	1.062
0.98	0.180	0.175	0.120	0.824	0.534	0.411	0.792	0.911	1.077
1.00	0.180	0.175	0.120	0.824	0.553	0.425	0.792	0.930	1.092
1.02	0.180	0.175	0.120	0.824	0.572	0.440	0.793	0.949	1.107
1.04	0.180	0.175	0.120	0.825	0.591	0.455	0.793	0.968	1.123
1.06	0.180	0.175	0.120	0.825	0.611	0.470	0.793	0.987	1.138
1.08	0.180	0.175	0.120	0.825	0.631	0.485	0.793	1.006	1.154
1.10	0.180	0.176	0.120	0.826	0.650	0.499	0.793	1.025	1.170

SYS V	P IN	DSG P	DSG Q	DSG PF	SYS P	SYS Q	SYS PF	LOAD V	EXCITN
0.90	0.200	0.192	0.134	0.821	0.443	0.343	0.791	0.837	1.042
0.92	0.200	0.192	0.134	0.821	0.461	0.356	0.791	0.856	1.056
0.94	0.200	0.193	0.134	0.821	0.480	0.370	0.791	0.875	1.070
0.96	0.200	0.193	0.134	0.822	0.498	0.385	0.792	0.894	1.084
0.98	0.200	0.193	0.134	0.822	0.517	0.399	0.792	0.913	1.099
1.00	0.200	0.194	0.134	0.822	0.536	0.413	0.792	0.932	1.113
1.02	0.200	0.194	0.134	0.822	0.555	0.428	0.792	0.951	1.128
1.04	0.200	0.194	0.134	0.823	0.575	0.443	0.792	0.970	1.143
1.06	0.200	0.194	0.134	0.823	0.594	0.457	0.793	0.989	1.159
1.08	0.200	0.194	0.134	0.823	0.614	0.472	0.793	1.008	1.174
1.10	0.200	0.195	0.134	0.824	0.634	0.487	0.793	1.027	1.190