October 1972 B72-10610

NASA TECH BRIEF

Goddard Space Flight Center

Computer Program Analyzes and Monitors Electrical Power Systems (POSIMO)

The problem:

To monitor and/or simulate power distribution, power balance and/or charge budget of a given power system, particularly of a complex system either on-line real-time or off-line speed-up.

The solution:

To design a power system which:

1. analyzes the power system and generates a set of characteristic power system data and
2. processes these power system data under the control of further input in the following, referred to as status indicators.

Status indicators are understood to be criteria to denote different exclusive conditions under which control of any of the power elements involved in the system can be operated, such as switch positions, flag settings, any kind of thresholds of voltage, temperature, attitude, etc.

How it's done:

The power system is considered to be a group of both power consuming or power donating power elements. Each element may be either a passive load or a load which may serve as a source for subsequent connected loads. The numerous combinations in which such a set of power elements can interact to form a particular power system can be expressed in terms of kind and number of serial and parallel interconnections between these elements. At the same time, the various power flow configurations in any such power system are determined on the one side by the N^2 combinations of the N status indicators and on the other side by the power dependent response of the sources involved.

The analysis of the power element combinations to a particular power system is performed by program POSIMO PREParation, while the calculation of the different power flow configurations and their inherent power balance and charge budget response is done by POSIMO EXECution.

POSIMO PREP will generate the required data set for POSIMO EXEC from three different sources of input: 1. a load - source - assignment list, 2. a load - status - assignment list, and 3. a set of coordinates denoting the efficiency versus power response of the different sources.

The outstanding feature of the approach lies in the simplicity of the lists to be entered, inasmuch as any list item refers to only one separate power element disregarding its connections and impacts on any of the remaining elements of the system. The first list simply states how much power from which response to which of the power elements is received or submitted. The second list is simply represented by the Boolean expressions of status indicators for each power element. Both the sequence of element names appearing in the two lists and the status indicators in the Boolean expressions may be written in random order.

Usually, one parameter (the nominal power) will be sufficient to describe the power property of a single power element. For increased flexibility, however, POSIMO is prepared to take up to 3 power parameters along with one parameter processing designator. If more than one parameter shall be employed, the user can easily insert his own processing routines.

(continued overleaf)

Notes:

1. Both POSIMO PREP and EXEC are written in FORTRAN IV language, .1POSIMO PREP for use on the IBM/360 computer and .2POSIMO EXEC which contains no I/O statements for use on any computer with FORTRAN IV capacity.
2. Basically, POSIMO can handle power systems of any extent and configuration if they can be described by the three input sources, as mentioned above. Limits due to reasonable array dimensions have been introduced into POSIMO for power systems considered to be sufficiently extensive and comprising up to 200 elements, 50 of which may be both loads and sources and up to 10 sources in series. The power systems may be controlled by up to 100 status indicators which may be combined in Boolean expressions with up to 8 ANDs and 8 ORs.
3. Inquiries concerning this program should be directed to:

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under contract to
Goddard Space Flight Center
(GSC-11505)