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AN ANNOTATED BIBLIOGRAPHY OF COMPUTER-AIDED CIRCUIT ANALYSIS AND DESIGN

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PREFACE

This document presents an annotated bibliography of computer-aided circuit analysis. Recent interest in the application of computers to the analysis of electronic circuits has encouraged the publication of this material. The emphasis has been placed on programs and their application rather than on related areas. The bibliography has been presented to furnish not only a listing of authors and their works but also an idea of how the area has developed over the past 10 years.

CONTENTS

INTRODUCTION

Over the past few years, computer-aided circuit analysis has grown to the point where it has generated a large body of literature in addition to the literature of the large fields of interest such as circuit analysis and computer programing which bear heavily on it. The intent of this bibliography is to cover the literature peculiar to computer-aided circuit analysis and include enough background material to allow the user to trace the thoughts that have been prevalent during the infancy of the subject. The papers are grouped by year and alphabetically by first author within the year to highlight the chronological development without sacrificing convenience of use. Subject and author indexes are included.

Special attention is called to two previous bibliographies (entries 95 and 150) where additional background and foreign-language references will be found.

The present bibliography begins with 1956, because it was about that time that the first serious attempts to use the computer as an aid to the analysis and design of electronic circuits were made, and ends about the middle of 1966.

1956

1. Wong, S. Y.; and Kochen, M.: Automatic Network Analysis With a Digital Computation System. Trans. Am. Inst. Elec. Engr., vol. 75, pt. I, 1956, pp. 172-175.

A study of techniques for using large digital computers in network analysis is included in this paper.

1957

2. Bashkow, T. R.; and Desoer, C. A.: Digital Computers and Network Theory. IRE WESCON Conv. Record, vol. 1, pt. 2, 1957, pp. 133-136.

This paper discusses the present and future effects on network theory of large scale digital computers.

3. Domenico, R. J.: Simulation of Transistor Switching Circuits on IBM 704. IRE, Trans. Electron. Computers, vol. EC-6, no. 4, Dec. 1957, pp. 242-247.

Rules of interconnection are presented for combining piecewise linear representations with the manipulation of the matrix equations that define the linear external circuitry.

4. Lasher, G. J.; and Morgan, J. C.: A General Method of Predicting the Transient Response of a Non-Linear Circuit. Res. Rept. RC-7, IBM Corp., Apr. 29, 1957.

A method making extensive use of the logical and arithmetic capabilities of a digital computer to predict the transient response of a nonlinear circuit is described and applied to a typical flip-flop. The data inputs required for this program are the values of the linear components, the subroutine description of the nonlinear components, and the nodal connections of all the circuit elements in punched card form.

5. Mayeda, W.; and Van Valkenburg, M. E.: Network Analysis and Synthesis by Digital Computer. IRE WESCON Conv. Record, vol. 1, pt. 2, 1957, pp. 137-144.

A program for the digital computer determination of driving-point and transfer functions for passive networks is described. With ILLIAC, networks with up to 30 elements have been analyzed. In the second part of the paper, the essentials of a digital computer library for network synthesis are described.

1958

6. Bird, B. M.: The Use of Digital Computers for the Design Calculations of Electrical Plant. Metropolitan Vickers Gaz., vol. 29, no. 473, Dec. 1958, pp. 312-316.

This article contains simulation of mental processes of the design engineer and programing for design calculations of dc motors.

7. Byerly, R. T.; Long, R. W.; and King, C. W.: Logic for Applying Topological Methods to Electric Networks. Trans. Am. Inst. Elec. Engr., vol. 77, pt. I, 1958, pp. 657-667.

This paper describes a computer analysis for networks of higher complexity, in which a connection matrix is used.

8. Byerly, R. T.; Long, R. W.; Baldwin, C. J., Jr.; and King, C. W.: Digital Calculation of Power System Networks Under Faulted Conditions. Trans. Am. Inst. Elec. Engr., vol. 77, pt. III, 1958, pp. 1296-1307.

This paper reviews the advantages of using digital computers for fault calculations.

9. Ferguson, R. W.; Long, R. W.; and Rindt, L. J.: Digital Calculation of Network Functions Used in Loss Formula Studies. Trans. Am. Inst. Elec. Engr., vol. 77, pt. I, 1958, pp. 647-652.

The result of this investigation was a digital computer program that calculated the self and mutual drops of a system with a high degree of accuracy and at the same time compared favorably with the ac network calculator method cost.

10. Geffe, P. R.: Predistorted Filter Design With a Digital Computer. IRE WESCON Conv. Record, vol. 2, pt. 2, 1958, pp. 10-22.

As a replacement for sets of tables this paper presents a program designed for a readily available commercial computer. The designer need only select the filter type, specify the order of the network and the values of element dissipation factor for which designs are required, and the computer yields element values together with the associated flat loss, in decibels.

11. Glimn, A. F.; Kirchmayer, L. K.; and Skiles, J. J.: Improved Method of Interconnecting Transmission Loss Formulas. Trans. Am. Inst. Elec. Engr., vol. 77, pt. III, 1958, pp. 755-760.

This paper presents an analytical study of an interarea matrix for power transmission loss formulas and a numerical example.

12. Hellerman, L.; and Racite, M. P.: Reliability Techniques for Electronic Circuit Design. IRE, Trans. Reliability Quality Control, vol. PGRQC-14, Sept. 1958, pp. 9-16.

An approach to the problem of designing reliability into an electronic circuit is the method of synthetic sampling. This method is compared to the commonly used "worst-case" design philosophy. This paper attempts to point up the shortcomings of the worst-case philosophy.

13. Hurless, H. D.: Computer Solves dc Load Flows. Elec. World, vol. 150, Dec. 8, 1958, p. 75.

Use is made of IBM 650 and 407 computers for load flow calculations, with solutions printed directly on system charts or in tabular form.

14. Mayeda, W.; and Van Valkenburg, M. E.: Analysis of Nonreciprocal Networks by Digital Computer. IRE Conv. Record, vol. 6, pt. 2, 1958, pp. 70-75.

This paper contains an ILLIAC computer study, with programing data.

15. Morris, E. F.; and Wohr, T. E.: Automatic Implementation of Computer Logic. Commun. Assoc. Computing Machinery, vol. 1, no. 5, May 1958, pp. 14-20.

An IBM 650 computer is used for calculating transistor circuits for the logic of an IBM computer under development.

16. Moskowitz, Fred: The Analysis of Redundancy Networks. Trans. Am. Inst. Elec. Engr., vol. 77, pt. I, 1958, pp. 627-632.

This paper is concerned with the analysis of series-parallel and bridge-type networks such as those involved in a radar system connected to a central computer.

17. Wallace, J. H.: Mechanical Method for Designing Switching Circuits. Western Elec. Engr., vol. 2, no. 4, Oct. 1958, pp. 43-48.

A numerical graphical design method that can be performed by computers is presented.

1959

18. Anderson, Charles V.; and Reed, Myril B.: The Digital Computer as a Tool for Network Analysis. Proceedings of the National Electronics Conference, Vol. XIV, c.1959, pp. 644-651.

This paper is a report on an exploratory investigation with a large digital computer (MISTIC) for analyzing electrical networks.

19. Branin, F. H., Jr.: The Relations Between Kron's Method and the Classical Methods of Network Analysis. IRE WESCON Conv. Record, vol. 3, pt. 2, 1959, pp. 3-28. (Also, TR 00.855, Develop. Lab., IBM Corp., Mar. 30, 1962.)

This paper compares Kron's method of piecewise analysis with the classical mesh and node methods of network analysis.

20. Brooks, Nancy G.; and Long, Harvey S.: A Program for Computing the Transient Response of Transistor Switching Circuits – PE TAP. TR 00.11000.700, Prod. Develop. Lab., IBM Corp., Dec. 1959.

An IBM 704 program for obtaining the transient response of a circuit is described. The program is designed to handle nonsaturating transistor and diode circuits. A detailed manual of operation is provided along with an example circuit and its response curves. A series of measured responses is compared with a corresponding series of computed responses in order to indicate the accuracy of the computations. (See entry 27 for a companion paper.)

21. Brown, R. Roderick: A Generalized Computer Procedure for the Design of Optimum Systems – Parts I and II. Trans. Am. Inst. Elec. Engr., vol. 78, pt. I, 1959, pp. 285-293.

Conventional design techniques cannot readily produce optimum solutions to present-day design problems. The ideal characteristics of a design procedure are reviewed herein and compared with the conventional techniques. A new technique for use with a digital computer is described. A sample design optimization is employed to illustrate the operation of the new technique.

22. Chang, Y. N.; and George, O. M.: Use of High-Speed Digital Computers To Study Performance of Complex Switching Networks Incorporating Time Delays. Trans. Am. Inst. Elec. Engr., vol. 78, pt. I, 1959, pp. 982-987.

An extension of the switching algebra notation has been developed to facilitate the analysis of sequential switching networks on a digital computer. The computer program described in this paper enables the engineer to study the dynamic performance of a complex switching network by including the actual time delays of the logical elements.

23. Dennis, J. B.; Nease, R. F.; and Saunders, R. M.: System Synthesis With the Aid of Digital Computers. Trans. Am. Inst. Elec. Engr., vol. 78, pt. I, 1959, pp. 512-515.

The conventional procedure for designing systems with many physical parameters is discussed and the translation of this procedure into digital computer operations is considered.

24. Hellerman, L.: Monte Carlo Analysis and Design Programs. TN 00.11000.354, Prod. Develop. Lab., IBM Corp., Apr. 22, 1959.

This note describes two IBM 704 programs which are useful in engineering design problems. The programs are Monte Carlo Analysis (MCAX), to determine reliability of dc levels in a given circuit, and Monte Carlo Design (MCDX), to optimize a given circuit design by changing circuit parameter values.

25. Keenan, T. A.; Cohen, G. H.; and Platnick, D.: Circuit Study Using Computer Techniques. Contract DA 36-039-sc-75048, Rochester Univ., July 15, 1959. (Available from DDC as AD 229 842.)

A part of this report covers a design procedure using the IBM 650 computer system to obtain the optimum terminal values for a single-stage transistor IF amplifier.

26. Sollecito, W. E.; and Swann, D. A.: Computer Evaluation of High-Temperature Aircraft a-c Electrical System Designs. Trans. Am. Inst. Elec. Engr., vol. 78, pt. II, 1959, pp. 434-444.

This paper describes the design of a high-temperature aircraft ac electrical system in which an analogue computer was used for the simulation of an alternator with balanced three-phase load and of a closed-loop voltage regulator system with torque limiting. The computer study shows the effects of temperature, load, and regulator and exciter nonlinear behavior on system stability and transient performance. Computer setup diagrams are given.

1960

27. Branin, F. H., Jr.: D-C Analysis Portion of PE TAP – A Program for Analyzing Transistor Switching Circuits. TR 00.11000.701, Prod. Develop. Lab., IBM Corp., May 27, 1960.

This report is a companion to entry 20 and includes an explanation of the dc initialization computation used in TAP and a description of a related program, PE DCAP, for handling dc network problems, either with or without transistors.

28. Crosby, D. R.; and Kaupp, H. R.: Calculated Waveforms for the Tunnel Diode Locked-Pair Circuit. Proceedings of the Eastern Joint Computer Conference, vol. 18, c.1960, pp. 233-240.

Circuit equations have been solved on a digital computer, and calculated curves of voltage and current waveforms are given for several frequencies up to 600 MHz.

29. Dunnet, Wallace J.; and Ho, Yu-Chi: Statistical Analysis of Transistor-Resistor Logic Networks. IRE Intern. Conv. Record, vol. 8, pt. 2, 1960, pp. 11-27.

This paper describes a general approach to statistical investigation of properties of complex transistor switching networks. By using measured statistical data of transistor parameters and randomly sampled circuit variables as input, a Monte Carlo analysis of the distribution of propagation delay is carried out on an IBM 709 computer.

30. Franks, David A.: A New Automatic Method for the Design of Low Voltage Transformers on the IBM 704. IRE Intern. Conv. Record, vol. 8, pt. 6, 1960, pp. 193-198.

A new technique for designing low-voltage transformers on a high-speed digital computer has been developed and programed for the IBM 704 electronic data processing machine. The program produces the manufacturing specifications in a form suitable for reproduction for use by shop personnel in manufacturing the transformer. The technique is described and some of the results obtained from the computer program with the technique are presented.

31. Johnson, Richard A.; and Brule, John D.: Diagnosis of Equipment Failures – Part 1. RADC-TR-60-67A, U.S. Air Force, Apr. 15, 1960. (Available from DDC as AD 236 188.)

Kletsky, Earl J.: Diagnosis of Equipment Failures – Part 2. RADC-TR-60-67B, U.S. Air Force, Apr. 15, 1960. (Available from DDC as AD 236 189.)

A systematic method of finding efficient diagnostic procedures is discussed in some detail. This paper summarizes the basic mathematical models and criteria for optimum procedures. Part 1 gives some results which indicate the effect of various maintenance procedures on the overall reliability of an equipment. Part 2 deals with applications of the theoretical work. To illustrate this work a diagnostic procedure for a physical piece of electronic equipment was prepared. In addition, a computer program has been developed to establish a possible logical structure for the automatic calculation of diagnostic procedures. This program also demonstrates the feasibility of machine computation.

32. Joyal, H. J.: Power-Supply Circuit Design by Digital-Computer Method. Elec. Mfg., vol. 65, no. 5, May 1960, pp. 171-177.

This paper describes the analysis and design of power supply circuits, for solid-state equipment, for example, with an IBM 704 electronic data processing machine.

33. Meyer, Charles Shelly: A Digital Computer Representation of the Linear, Constant-Parameter Electric Network. 8436-TM-3 (Contract AF 33(600)40604), Electron. Syst. Lab., Massachusetts Inst. Technol., Aug. 1960. (Available from DDC as AD 248 437.)

A digital computer routine resulting in a set of equations that can be solved for the branch currents or branch voltages of a linear, constant-parameter electric network is described. Advantages are obtained from the unique branch numbering system which affords the circuit analyst the opportunity of specifying tree or link branches. Other

existing computer routines are studied, and a comparison is made with the method of this research. Detailed flow charts are presented, and a sample circuit is analyzed.

34. [Remington Rand Univac]: Mathematical Circuit Analysis and Design. AFCRC-TN-60-358, U.S. Air Force, Feb. 29, 1960. (Available from DDC as AD 238 354.)

This report describes an attempt to develop a mechanized routine for the design and fault diagnosis of electronic circuits, summarizes the progress to date, and suggests areas for future study. A sample circuit is given; a copy computer printout accompanies the description of each stage of the analysis.

35. Sato, N.: Digital Calculation of Network Inverse and Mesh Transformation Matrices. Trans. Am. Inst. Elec. Engr., vol. 79, pt. III, 1960, pp. 719-726.

The object of this paper is to show a definite correspondence between the matrices obtained from the mesh and the nodal methods, and from this relation obtain the mesh and nodal inverse matrices by means of the elimination scheme and an efficient method in calculating the mesh transformation matrix.

36. Starner, Duane: Transient Response of Some Distributed Parameter Configurations – Part I. LMSD-703095, Lockheed Aircraft Corp., Sept. 1960. (Available from DDC as AD 245 993.)

A study of the transient response of particular distributed parameter networks is described. An exact analysis is presented for checking approximation methods. Theoretical and experimental responses are compared and a computer program is given for evaluation of the theoretical responses.

37. Taylor, G. E.; Carter, G. K.; and MacDonald, E. H.: New Digital Computer Short-Circuit Program for Relay Studies. Trans. Am. Inst. Elec. Engr., vol. 79, pt. III, 1960, pp. 1257-1264.

This paper describes and discusses an IBM 704 program which uses load-flow data of a system and performs fault calculations to assist in the application of protective relays to power systems.

38. White, D. R. J.: Digital Simulator Checks Space Communications Design. Space/Aeron., vol. 34, no. 1, July 1960, pp. 125-129.

This article describes methods of evaluating the design of ground—space-vehicle radio transmission systems with a digital computer.

39. Wildfeuer, David: The Use of Automatic Digital Computation Machine in Design of Miniature Pulse Transformers and Power Transformers. Proceedings of the National Electronics Conference, vol. XVI, c.1960, pp. 631-651.

This paper describes in detail the application of a general purpose digital computer to the design of miniature pulse transformers and power transformers. For each type of component a flow chart is presented which describes the computation flow. For each of the categories the machine prints out computed electrical and magnetic characteristics in association with coil details and core structure. Sample problems of machine-designed pulse transformers and a power transformer are presented.

1961

40. Bartee, T. C.: Computer Design of Multiple-Output Logical Networks. IRE, Trans. Electron. Computers, vol. EC-10, no. 1, Mar. 1961, pp. 21-30.

This paper presents a procedure for the design of multiple-output logical networks which are minimal according to certain criteria. The technique has been programed for the IBM 709 and some of the details of the program are presented. The program accepts punched cards listing the in-out relations for the network and then prints a list of Boolean expressions which are minimal according to a selected one of three criteria.

41. Beaudette, J. H.; and Honkanen, P. A.: Circuit Analysis of Nonlinear Systems, PE CANS. Sci. Computation Dept., IBM Corp., Aug. 14, 1961.

This report describes the mathematics behind and the usage of the PE CANS program. The basic assumption made in PE CANS is that a circuit can be accurately represented by a network of constant and/or nonlinear circuit elements; thus, there is no equivalent circuit for transistors or other devices that is incorporated into the program. The circuit elements can be nonlinear to almost any extent as long as they have a single value for the independent variable.

42. Bell, J. E.; and Walker, K. R.: Theoretical Study of Burst Induced Transient Radiation Effects in Basic Electronic Circuits. AFSWC-TR-61-40, U.S. Air Force, May 15, 1961.

An analogue computer technique is shown to be a powerful tool for the theoretical investigation of transient radiation effects on electronic circuits.

43. Bickley, H. D.; Brandt, D. R.; Cage, J. B.; and Skiles, J. J.: Digital Techniques for Voltage Regulation Studies. Autom. Control, vol. 15, no. 6, Dec. 1961, pp. 26-30.

This article discusses the representation of bus voltage regulation by automatic tap-changing transformers, generator bus voltage control, change of bus tie arrangements, and use of switched capacitors in the realistic digital simulation of system operation in power flow studies.

44. Branin, Franklin H., Jr.: Machine Analysis of Networks. TN 00.490, Devel. Lab., IBM Corp., Mar. 7, 1961. (Also, TR 00.855, Develop. Lab., IBM Corp., Mar. 30, 1962.)

This report begins with a description of certain fundamental topological properties of linear graphs. The network problem, as a distinct mathematical entity, is then formulated in an abstract manner in order to show its algebraic structure. Next, the electrical network problem is described along with its solution by the classical mesh and node methods. Finally, a theorem stipulating a sufficient condition under which solution to the network problem exists is explained.

45. Branin, F. H., Jr.: An Abstract Mathematical Basis for Network Analogies and Its Significance in Physics and Engineering. Electromechanical Energy Conversion, Am. Inst. Elec. Engr., 1961, pp. 12-32. (Also, TR 00.855, Develop. Lab., IBM Corp., Mar. 30, 1962.)

This report emphasizes the theoretical importance of the network concept and its practical value in computing solutions to a wide variety of physical problems. The abstract mathematical characteristics of the network problems are delineated in order to establish exact ground rules for setting up network models.

46. Cohen, G. H.; and Platnick, D.: The Design of Transistor IF Amplifiers Using an IBM 650 Digital Computer. IRE, Trans. Circuit Theory, vol. PGCT-8, no. 3, Sept. 1961, pp. 237-243.

This paper describes a method of designing IF amplifiers using a digital computer. Input data consist of sets of two-port parameters measured over the frequency range of interest, a stability factor ρ, and the desired bandwidth. Several examples are given.

47. Desoer, Charles A.; and Mitra, Sanjit K.: Design of Lossy Ladder Filters by Digital Computer. IRE, Trans. Circuit Theory, vol. PGCT-8, no. 3, Sept. 1961, pp. 192-201.

This paper presents a method for designing lossy filters built with elements having unequal dissipation factors using a high-speed digital computer as the main tool. Results

of using the suggested method in designing a lossy Tchebycheff filter of degree 9 are included. Also included are details on programing methods.

48. Fall, J. V.: A Digital Computer Program for the Design of Phase Correctors. IRE, Trans. Circuit Theory, vol. PGCT-8, no. 3, Sept. 1961, pp. 223-236.

A program for the design of an all-pass function, with n natural modes, to correct the phase of a prescribed transfer function is discussed. Adequate results have been obtained with 8 or 10 natural modes. The speed of the program depends on the number of basic iterations of the design process which varies from 1 to 10. On a Ferranti Mercury computer with $n = 8$, the basic iteration is 20 seconds.

49. Fielder, Daniel C.: A Combinatorial-Digital Computation of a Network Parameter. IRE, Trans. Circuit Theory, vol. PGCT-8, no. 3, Sept. 1961, pp. 202-209.

In order to avoid numerical iteration in the calculation of a typical return-loss coefficient of an LC latter structure, combinatorial analysis methods are used to form equations which defer inclusion of the problem data until an advanced state in the solution. Three different combinatorial procedures are included. The network parameter calculation serves as an example to demonstrate these combinatorial methods and the applicability of digital computers to combinatorial procedures.

50. Gangel, M. W.; and Green, W. W.: 32-Step Voltage-Regulator Performance. Trans. Am. Inst. Elec. Engr., vol. 80, pt. III, 1961, pp. 559-567.

This paper presents the mutual relationship between regulator control settings, tap-changer operations, and the characteristics of the output voltage for step-voltage regulators using representative distribution system voltage profiles obtained in the field. A description is given of the procedure employed, which included the use of detailed voltage recordings for distribution feeders as input to analog computer and digital computer simulations of a 32-step regulator and its associated controls.

51. Goldstick, G. H.; and Mackie, D. G.: Design of Computer Circuits Using Linear Programming Techniques. IRE Intern. Conv. Record, vol. 9, pt. 2, 1961, pp. 224-240.

A step-by-step procedure for formulating circuit synthesis problems in a manner which is amenable to a solution using linear programing is presented. A method of systematizing component value determination using linear programing is explained. The design equations and conditions required to synthesize a diode coupled inverter and a design procedure for achieving an optimum circuit is presented. The Simplex Method is used to determine component values such that power dissipation is minimized.

52. Gupta, P. P.; and Davies, M. W. Humphrey: Digital Computers in Power System Analysis. Proc. Inst. Elec. Engrs. (London), pt. A, vol. 108, 1961, pp. 383-398.

This paper presents some methods of using a digital computer for solving problems in power system analysis. The methods are similar to those used on network analyzers. Programs have been developed for performing load studies and transient stability studies.

53. Haynes, Munro K.: Transient Analysis of Cryotron Networks by Computer Simulation. Proc. IRE, vol. 49, no. 1, Jan. 1961, pp. 245-257.

A general method is derived for transient analysis of complicated nonlinear dynamical systems by use of a digital computer. An IBM 704 program is presented for simulation of cryotron networks. This simulator has been used to study switching speeds of cross-latched cryotron flip-flops; five-stage, free-running, ring circuits; and a three-bit, self-timing, self-checking, binary, parallel adder.

54. Hellerstein, Simon: Synthesis of All-Pass Delay Equalizers. IRE, Trans. Circuit Theory, vol. PGCT-8, no. 3, Sept. 1961, pp. 215-222.

This paper describes a systematic-synthesis technique whereby a given delay characteristic is approximated within a given error with a small number of all-pass network sections. The method is a generalization of Darlington's using the Tchebycheff polynomial series. As an application, a three-section delay equalizer for color television was designed with the IBM 650 computer which had better performance than a four-section equalizer now in use.

55. Jervis, E. R.: Study of Factors Affecting System Reliability. Publ. No. 148-2-248 (Contract SD-51-3), ARINC Res. Corp., July 17, 1961. (Available from DDC as AD 272 191.)

A method of failure data collection for reliability prediction purposes is outlined which utilizes a computer program so that all required items of information can be automatically fed into the process of data accumulation and the required failure rate information can be obtained from the computer.

56. John, M. N.: A General Method of Digital Network Analysis Particularly Suitable for Use With Low Speed Computers. Proc. Inst. Elec. Engrs. (London), pt. A, vol. 108, 1961, pp. 369-382.

This paper describes the network, theory, program details, and application in power system studies of a general method of digital network analysis particularly suited for low-speed computers. The method has been proved using both high- and low-speed computers and the results of sample load-flow and short-circuit studies are discussed. The method is also applicable to transient stability problems.

57. Kirby, D. B.; and Rosenthal, C. W.: Computer Program for Preparing Wiring Diagrams. Trans. Am.Inst. Elec. Engr., vol. 80, pt. I, 1961, pp. 509-513.

An account is given of an IBM 704 program for preparing chassis wiring diagrams from a list of the chassis terminals to be connected.

58. Leon, B. J.; and Bean, C. A.: Analysis and Design of Parametric Amplifiers With the Aid of a 709 Computer. IRE, Trans. Circuit Theory, vol. PGCT-8, no. 3, Sept. 1961, pp. 210-215.

The linear circuit model used to characterize the small signal performance of single-diode parametric amplifiers consists of a single sinusoidally varying capacitance imbedded in a fixed parameter network. An IBM 709 program for precise analysis of this circuit model is presented. Besides computing the response at the normal signal and idler frequencies, the program also computes the amplitudes of the voltages at the various other frequencies generated by the mixing action of the time-variant element.

59. Lock, Kenneth: A Digital-Computer-Programmed Topological Method of Coordinate Selection for Numerical Computations in an Electrical Network. Ph.D. Dissertation, California Inst. Technol., [1961].

An algorithm is developed for setting up the differential equations and initial conditions of electrical networks of arbitrarily connected elements. The algorithm formulates the equations in a set of coordinates such that all matrices to be inverted are nonsingular. The topological description of the circuit is used to select a nonsingular set of coordinates which enables the computation of the transient responses.

60. Merritt, Philip E.: Design of Circuits To Tolerate a Range of Transistor Parameters. Active Networks and Feedback Systems, Polytech. Press of Polytech. Inst. Brooklyn, c.1961, pp. 437-447.

Circuit design methods are presented that account for component variations such as those exhibited from transistor to transistor of a single type. An illustrative design is discussed in which the Q and turns ratio of transformers in an IF amplifier are chosen to minimize the spread of a prescribed gain.

61. Pacello, E. A.: The Use of "Deuce" for Network Analysis. Marconi Rev., vol. XXIV, no. 142, Third Quarter 1961, pp. 101-114.

"Deuce" programs for computing network responses are described. The networks are assumed to consist of sections arranged in tandem. The sections are simple three- or four-terminal networks which have one of the structures: shunt and series branch (ladder network), bridged-T, or lattice.

62. [Remington Rand Univac]: Mathematical Circuit Analysis and Design. AFCRL 191, U.S. Air Force, Mar. 1961.

This report describes the application of mathematical techniques to the analysis of the steady-state performance of a transistor gate-inverter circuit. The statistical calculation of circuit behavior is discussed and results are presented for the computer analysis of a typical circuit. A detailed mathematical description of the technique for determining the maximum component tolerance is included and the subsequent statistical study indicates the importance of the maximum tolerance determination in circuit design.

63. Scheffler, H. S.; Stember, L. H., Jr.; and Duffy, J. J.: Circuit-Analysis Techniques Utilizing Digital Computers. Proceedings Seventh National Symposium on Reliability & Quality Control in Electronics, IRE, c.1961, pp. 361-374.

This paper has been written to describe a generalized technique of circuit analysis that makes use of the capabilities of high-speed digital computers. This technique, at present, will provide the designer with (1) information on the part-parameter drift stability required to allow his circuit to perform within required limits, (2) graphs of the interdependence of part parameters as related to circuit performance, and (3) data on voltage and power stresses imposed on the parts in the circuit as voltages and parameter values change.

64. Scheffler, H. S.; and Terry, F. R.: Description and Comparison of Computer Methods of Circuit Analysis. Rept. No. EM-6839, Autonetics, June 30, 1961. (Available from DDC as AD 292 321.)

Computer circuit-analysis techniques are discussed which are used to determine projected performances of newly designed electronic circuits considering normal part-parameter variations. The report describes each component-variation circuit-analysis method in detail and how each method is applied to a deficient sample circuit, shows how each method pinpoints circuit deficiencies, and presents problem circuits to be set up for each method. Also flow charts and IBM 7090 programs for each of the methods appear in an appendix.

65. Yamamoto, K.; Fujimoto, K.; and Watanabe, H.: Programming the Minimum-Inductance Transformation. IRE, Trans. Circuit Theory, vol. PGCT-8, no. 3, Sept. 1961, pp. 184-190.

This paper presents a method of calculation for the frequency transformation of a low-pass filter into a band-pass filter with a minimum number of inductances. The computation formulas and rules, which are described in detail, are suitable for the use of an automatic digital computer. The flow charts of the programing are illustrated in

some detail with a numerical example carried out on a Nippon Electric Automatic Computer Type 2203.

1962

66. Azgapetian, Victor: Computer Assists Servo Design. Instr. Control Syst., vol. 35, no. 8, Aug. 1962, pp. 81-85.

An illustrated discussion is presented of the steps in servomechanism design where the computer can and cannot be used to good advantage.

67. Branin, Franklin H., Jr.: d-c and Transient Analysis of Networks Using a Digital Computer. IRE Intern. Conv. Record, vol. 10, pt. 2, 1962, pp. 236-253. (Also, TR 00.855, Develop. Lab., IBM Corp., Mar. 30, 1962.)

An experimental program is described for computing the dc and transient response of transistor switching circuits of arbitrary configuration and size (up to 20 transistors) with the IBM 704 computer. A feature of the program which is discussed is its ability to compile all the necessary equations automatically from input data describing the circuit parameters and configuration.

68. Brown, Albert; and Mullock, Philip J.: Mathematical Circuit Analysis and Design. AFCRL-62-317, U.S. Air Force, Mar. 1962.

This report covers two investigations. The first describes the statistical and other computational methods including a generalized digital computer program for the performance of a Monte Carlo analysis. The second part is devoted to the study of magnetic core circuits.

69. Clark, Omer P.: Design of Transistor Feedback Amplifiers and Automatic Control Circuits With the Aid of a Digital Computer. IRE Intern. Conv. Record, vol. 10, pt. 2, 1962, pp. 228-231.

A method of designing transistor feedback transmission amplifiers with the aid of a nodal analysis digital computer program is described. A procedure for using this nodal analysis program during the design of automatic control systems is also included. This computer program is referred to as NAPANS for "Nodal Analysis of Passive and Active Networks."

70. Clunies-Ross, C.; and Husson, S. S.: Statistical Techniques in Circuit Optimization. Proceedings of the National Electronics Conference, vol. XVIII, c.1962, pp. 325-334.

This paper characterizes a circuit design by the probabilities of failure on each specification and the optimum design is defined as the one with the minimum-maximum

failure probability. A Monte Carlo sampling technique is used to estimate the failure probabilities.

71. Dujack, R. L.; and Epstein, D. I.: Digital Computer Simulation of Communication Networks. IRE, Trans. Commun. Syst., vol. CS-10, no. 1, Mar. 1962, pp. 118-125.

This paper is concerned with a digital computer simulation technique for implementing the modeling approach of communications networks, and some examples of its applications are presented. The computer program (for the IBM 709) accepts a wide range of parameters such as traffic level, system topologies, and system operating rules. Outputs are system performance parameters such as blocked call probabilities and user-to-user delays.

72. Geffe, Philip R., ed.: Computer Program Reviews. IRE, Trans. Circuit Theory, vol. CT-9, no. 3, Sept. 1962, p. 307.

Reviews of the following computer programs are given:

(1) Kahng, S. W.: A Program for All-Pass Network Synthesis.

(2) Tollefsrud, V. C.: A Computer Program for Obtaining Minimum-Inductance Band-Pass Filters.

(3) Smith, K. E.: Image Parameter Band-Pass Filter Design Using the IBM-650.

(4) Geffe, P. R.: Six Computer Programs for Modern Filter Design.

73. Hellerman, L.: A Computer Application to Reliable Circuit Design. IRE, Trans. Reliability Quality Control, vol. RQC-11, May 1962, pp. 9-18.

The problem of reliable electronic circuit design by statistical methods is described. After a brief account of the history of this problem, the principle is given of one method – Monte Carlo. Two implementations of this method, as digital-computer programs, are given. The first program analyzes the reliability of a given circuit, and the second program picks component values to optimize the circuit behavior with respect to several performance aspects. Examples illustrating the nature of the input and output information are included.

74. Henry, H. E.; and Schultheiss, P. M.: The Analysis of Certain Nonlinear Feedback Systems With Random Inputs. IRE, Trans. Inform. Theory, vol. IT-8, no. 4, July 1962, pp. 285-291.

A method is developed for the determination of the probability density function of the output of a nonlinear feedback system whose input is a random voltage of known statistical properties. The method of analysis is based upon the establishment of a

mathematical model of the feedback system in such a way that the output is a Markov process. The results of an IBM 704 study of this system are presented and discussed.

75. Hosking, K. H.; Kavanagh, B. M. J.; and Sadler, M.: The Application of "Deuce" to the Analysis of Linear Passive Networks. Marconi Rev., Vol. XXV, Second Quarter 1962, pp. 139-156.

This article describes some of the methods which are available for the determination of the time-domain responses of systems whose transfer functions are known, with particular emphasis on the utilization of a number of "Deuce" programs which have been specially prepared for this purpose.

76. Jelinek, H. J.; and Webb, H. W.: The Development and Performance of Reliability Analyses. EM-6839-2, Autonetics, Aug. 1, 1962. (Available from DDC as AD 424 308.)

This document presents a detailed procedure for development of the information which is necessary to perform a reliability analysis on a circuit. Reliability analyses on two sample circuits, a Schmitt Trigger Circuit and a Logic Driver Circuit, are given to supplement and clarify the procedure.

77. Lechler, A. P.; Mark, D. G.; and Scheffler, H. S.: Applying Statistical Techniques to the Analysis of Electronic Networks. 1962 Proceedings National Aerospace Electronics Conference, IRE, May 1962, pp. 168-172.

This paper describes two techniques, the Monte Carlo Method and the Moment Method, that have been developed for estimating the reliability of electronic circuits.

78. Parton, K. C.; and Newey, D. A.: Power-System Design – New Techniques. GEC J. Sci. Technol., vol. 29, no. 1, 1962, pp. 9-19.

An account is given of equipment, namely a network analyzer operating on the transformer-analog principle and a Mercury digital computer, used by the authors in solving electrical power system problems. Various examples of studies undertaken are briefly outlined.

79. Scheffler, H. S.; Duffy, J. J.; and Spradlin, B. C.: MANDEX – A Worst-Case Circuit Analysis Computer Program. 1962 Proceedings National Aerospace Electronics Conference, IRE, May 1962, pp. 38-53.

This paper explains the Modified AND EXpanded (MANDEX) worst-case circuit analysis program which utilizes a digital computer to determine the effects of variation in circuit input and part parameters on circuit performance. In the MANDEX method, the computer calculates the first derivative of all the output variables with respect to the

input parameters and, using these derivatives, sets the input parameters to their end-of-life condition so that a worst-case solution for the output variable is obtained. The computer determines whether performance is acceptable at this worst-case condition and prints circuit information accordingly. This procedure is repeated for all output variables. In addition to determining whether a circuit design will meet worst-case criteria, the program provides the designer with information to aid in improving the design.

80. Semmelman, C. L.: Experience With a Steepest Descent Computer Program for Designing Delay Networks. IRE Intern. Conv. Record, vol. 10, pt. 2, 1962, pp. 206-210.

A computer program has been written for the purpose of designing networks by a successive approximation technique. The program performs two operations alternately: calculating the improvement made possible by a small change in each network design parameter and making larger changes in all parameters to reduce the error in performance. The program is written in FORTRAN-II language for IBM 704 or 7090 electronic data processing system with 16 or 32 K storage.

81. Strom, Russel: Programming Computers To Perform Circuit Design on a Statistical Basis. Elektron. Rechenanlagan, vol. 4, no. 6, 1962, pp. 254-257.

This article is a review of standard techniques for arriving at a statistical distribution for circuit performance parameters. Fifteen references are cited and their work compared. Generalized flow diagrams are given for computer programs to perform statistical analysis.

82. Temes, G. C.: Filter Synthesis Using a Digital Computer. IRE Intern. Conv. Record, vol. 10, pt. 2, 1962, pp. 211-218.

This paper classifies and gives a brief description of the digital computer programs that were found to be most useful in filter calculations. Several representative examples are included.

1963

83. Anon.: ASAP, An Automated Statistical Analysis Program – Part One. Contract NAS5-3373, IBM Corp., [1963].

By using a nodal description of the circuit in an English text, free-format input style, ASAP will write the circuit equations, solve them algebraically, write and compile a FORTRAN subroutine, and run the Monte Carlo statistical analysis. A detailed description of each of these steps is presented.

84. Applegate, F. A.: Statistical Circuit Analysis Based on Part Test Data. Electro-Technol. (New York), vol. 71, no. 5, May 1963, pp. 140-145.

Circuit synthesis is only as good as the component-part data used. Because of this dependence, considerable effort must be expended in designing an accurate and efficient component-part test program. The results of the program can then be used in the statistical worst-case analysis of the circuit in which the parts are to be used.

85. Breen, H. T.; and Webb, H. W.: SYCATE, A Digital Computer Program. Proceedings National Winter Convention on Military Electronics, vol. II, R. F. Lander, ed., IEEE, c.1963, pp. 6-41 – 6-48.

The SYCATE program uses a mathematical model of a circuit in conjunction with a digital computer to predict the values that will occur at circuit test points when one or more of the circuit parts or input sources have failed. When a circuit subsequently fails, examination of the circuit test-point values and comparison with the output information of the computer program will then yield an indication of the most probable cause or causes of the circuit failure.

86. Carter, E. V.: Thermal Analysis of Integrated Circuits. Proceedings of Second Design Aids Symposium, Pub. No. 558-A-14, Autonetics, Sept. 1963, pp. II-1 – II-15.

A digital computer program has been written to solve temperatures inside integrated circuits. It uses the technique of dividing the integrated circuit into small cubes and tracing the heat flow from cube to cube. Pictorial output and problem optimization are features of the program.

87. Casady, L. C.; and Breen, H. T.: Transistor and Diode State Finding Routine. Proceedings of Second Design Aids Symposium, Pub. No. 558-A-14, Autonetics, Sept. 1963, pp. V-1 – V-5.

This paper presents a subroutine for a circuit analysis program to determine if a transistor is in the active, cutoff, or saturated regions and whether diodes are reversed or forward biased.

88. Duby, T. E.: Linear Circuit Analysis Using the SPADE Program. Proceedings of Second Design Aids Symposium, Pub. No. 558-A-14, Autonetics, Sept. 1963, pp. I-1 – I-25.

S-Plane and Determinant Expansion (SPADE) is a FORTRAN program which will solve up to a 20 by 20 matrix with polynomial elements describing a linear circuit for any or all the unknowns in terms of the Laplace operator. It will then run a frequency response, iterate specific component values, and plot the results on CRT graphs.

89. El-Abiad, A. H.: Digital Computer Analysis of Large Linear Systems. Proceedings First Annual Allerton Conference on Circuit and System Theory, J. B. Cruz, Jr., and John C. Hofer, eds., Univ. of Illinois, 1963, pp. 205-220.

The network approach is used as a unifying basis for formulating and solving a wide variety of problems on the digital computer. There is complete duality in the formulation network equations between the nodal and loop frames of reference; thus, the computer may choose the most advantageous frame of reference within the same program.

90. Green, Lewis F.: Switching Circuit Analysis Program, SCAP-1. LAMS-2986 (Contract W-7405-eng-36), Los Alamos Sci. Lab., Univ. of California, Nov. 25, 1963.

SCAP-1 is intended to aid the machine-control-design engineer in verifying the functional logic of electrical and hydraulic machine control circuitry. Usage is limited to on-off circuits, and the determination of numerical values of outputs is beyond the scope of the program.

91. Iedokoro, Tokuju; Tsuchiya, Tohoru; and Watanabe, Hitoshi: A New Calculation Method for the Design of Filters by Digital Computer With the Special Consideration of the Accuracy Problem. IEEE Intern. Conv. Record, vol. 11, pt. 2, 1963, pp. 100-109.

This paper presents the fundamental consideration for the accuracy problem in the field of filter design and a new calculation method for network design by a digital computer which permits a reduction in the accumulations of numerical errors. Design formulas and numerical examples are given.

92. Kimme, E. G.; and Kuo, F. F.: Synthesis of Optimal Filters for a Feedback Quantization System. IEEE Intern. Conv. Record, vol. 11, pt. 2, 1963, pp. 16-23.

IBM 7090 computer programs are described to calculate tap-weights on tapped delay lines and least-squares approximations for filter functions.

93. Klion, Jerome: Statistical Design Techniques. RADC-RAS-TM-63-3, U.S. Air Force, May 1963.

This paper traces the development of the application of statistical techniques from their first simple fundamentals to the sophisticated procedures which are being investigated for near future application.

94. Miles, R. S.: Transient Response Using Matrizant Procedures. Proceedings of Second Design Aids Symposium, Pub. No. 558-A-14, Autonetics, Sept. 1963, pp. IV-1 – IV-49.

The Transient Response Using Matrizant Procedures (TRUMP) program calculates the transient response of linear and nonlinear electronic circuits. Topological circuit description and element values are required inputs. Voltage, current, and power as functions of time are outputs.

95. Pierce, Charlie M., compiler: The Design and Analysis of Electrical and Electronic Systems by Means of Digital Computers: An Annotated Bibliography. 2-60-63-2/SB-63-65 (Contract NOw 63-0050-C), Lockheed Missiles & Space Co., Sept. 1963.

This bibliography contains 63 references listed alphabetically by author. Indexes are included for corporate author, personal author, and subject.

96. Ross, Douglas T.; and Rodriguez, Jorge E.: Theoretical Foundations for the Computer-Aided Design System. AFIPS Conference Proceedings, Volume 23 – 1963 Spring Joint Computer Conference, Spartan Books, Inc., 1963, pp. 305-322.

This paper presents some concepts of language and structure that are necessary in the design of a general problem solver. A servomechanism design problem illustrates their application.

97. Stempin, C. W.: Application of Matrizant Operators for General Network Response. Proceedings of Second Design Aids Symposium, Pub. No. 558-A-14, Autonetics, Sept. 1963, pp. III-1 – III-28.

A definition of the matrizant operator and its relation to the operational calculus are presented. Applications of this operator to linear networks are given with emphasis on digital computer solutions.

98. Szentirmai, G.: Theoretical Basis of a Digital Computer Program Package for Filter Synthesis. Proceedings First Annual Allerton Conference on Circuit and System Theory, J. B. Cruz, Jr., and John C. Hofer, eds., Univ. of Illinois, 1963, pp. 37-49.

The paper describes the theory used for a computer program package being developed at the Bell Telephone Laboratories. The program will handle low-, high-, and band-pass filters with prescribed attenuation peak positions. Provisions are made for either equal ripple, or maximally flat-type pass-band behavior, for arbitrary (including extreme) termination ratio and predistortion of dissipation, if required. Additional subroutines provide the elliptic solution or the required number and positions of attenuation peaks for prescribed arbitrary suppression requirements. A modified program provides

low- and band-pass filters with maximally flat or equal-ripple type delay in their pass band and monotonic or equal-minima type loss in their suppression band.

1964

99. Anon.: Part I – Computer-Aided Electronic Circuit Design. Rept. ESL-SR-225 (NASA Res. Grant NsG-496), Massachusetts Inst. Technol., Dec. 1964.

The objective of the work covered in this report is to exploit the digital computer as a tool for designers of electrical circuits. Work has been started under the headings of computer-aided circuit analysis, synthesis of logic circuits, and threshold logic. The status of each of these efforts is presented.

100. Atwood, A. G.; and Drew, L. C.: Computer Analysis of an Integrated Circuit Amplifier. RCA Integrated Circuits, c.1964, pp. 21-23.

This paper describes a mathematical approach, utilizing a computer, for predicting the behavior of an active linear circuit after it has been integrated. The computer analysis technique described herein is based upon the nodal equations of a complete amplifier. It provides a unified approach to linear circuit analysis in place of the conventional approach requiring three separate equivalent circuits (one each for low, midband, and high frequencies). Further, this technique is applicable to any system which can be described by a set of linear simultaneous complex equations.

101. Bingham, J. A. C.: A New Method of Solving the Accuracy Problem in Filter Design. IEEE, Trans. Circuit Theory, vol. CT-11, no. 3, Sept. 1964, pp. 327-341.

This paper shows how a transformed variable obtained by a well-known bilinear transformation of the frequency (variable) can be used at all stages of the synthesis process.

102. Buchsbaum, L.; Dunning, M.; Hannom, T. J. B.; and Mah, L.: Investigation of Fault Diagnosis by Computational Methods. APL TDR 64-62, U.S. Air Force, May 1964. (Available from DDC as AD 601 204.)

The technique formulated uses circuit equations. All circuit equations used in the diagnosis are generated numerically by the computer from the specification of the circuit schematic in coded form and from the nominal values of all circuit components. Three diagnostic techniques are included. They involve the numerical network admittances which are automatically generated from the coded schematic.

103. Burns, R. C.; and Lawson, A. D.: Quantized Probability Circuit Design Principles Applied to Linear Circuits. IEEE, Trans. Reliability, vol. R-13, no. 2, June 1964, pp. 16-28.

This paper describes a method which weights the probable component variation from its nominal value into one of three groups; the group assignment depends on how seriously the component variation affects over-all performance. This technique, identified as the quantized probability design method, is compared with the absolute worst case, the Taylor worst case, and the uniform probability methods.

104. Calahan, D. A.: Computer Generation of Equivalent Networks. IEEE Intern. Conv. Record, vol. 12, pt. 1, 1964, pp. 330-334.

The theory of continuously equivalent networks is extended to the state equations and to include a scaling option. The theory is then applied to the classical problem of the design of low- and band-pass filters with loss in inductors only. The alinement problem in active filters is also approached from an equivalence viewpoint.

105. Falk, Howard: Computer Programs for Circuit Design. Electro-Technol. (New York), vol. 73, no. 3, Mar. 1964, pp. 101-104, 162-164.

This paper contains a listing and description of computer programs for circuit analysis and design. See also entry 153.

106. Fryer, W. D.; and Schultz, W. C.: A Survey of Methods for Digital Simulation of Control Systems. Rept. CAL-XA-168-1-E-1, Cornell Aeron. Lab., Inc., July 1964.

This report is the result of an extensive study of the many methods of simulating system transfer functions and complete control systems on a general-purpose, large-scale digital computer. Two special simulation techniques (DEPI and DYSAC) are also discussed. In these methods, the digital computer essentially simulates an analog computer, at least in the sense of the programing procedure.

107. Geffe, Philip R., ed.: Computer Program Reviews. IEEE, Trans. Circuit Theory, vol. CT-11, no. 4, Dec. 1964, p. 512.

Reviews of the following computer programs are given:

(1) Calahan, D. A.: A General Linear Network Analysis Program.

(2) Goodnuff, J. L.; and Tokad, Y.: A Computer Program for Resistive Network Synthesis.

108. Huber, E. Allen; and Grossberg, Phyllis J.: A Computer Program for the Frequency Analysis of Linear Electrical Networks. EDL-M752 (Contract DA-36-039-AMC-03404(E)), Sylvania Elec. Prod., Inc., Oct. 30, 1964. (Available from DDC as AD 460 160.)

A computer for performing frequency analysis of linear electrical networks with up to 40 nodes is described. The network is described to the program by a list of the types of elements, their node connections, and their values. The frequency functions to be calculated are defined by choosing from a prepared set of equations and listing the variables to be used in these equations.

109. Jelinek, H. J.; and Frola, F. R.: Achieving Circuit Reliability With Linear Programming. Proceedings Tenth National Symposium on Reliability & Quality Control, IEEE, c.1964, pp. 525-537.

This paper describes a method of circuit design which guarantees minimum circuit power dissipation while, at the same time, assuring circuit function. The design is expressed in a so-called "min-max" formulation. A test, called the "ρ-test," is devised to check the design specifications for physical realizability. An expression relating the circuit power dissipation to the circuit parameters is obtained. This expression combined with the min-max formulation constitutes a linear programing problem which is subsequently solved with a digital computer.

110. Radiation Effects Dept., IBM Corp.: Automated Digital Computer Program for Determining Responses of Electronic Systems to Transient Nuclear Radiation. WL-TDR-64-62, Vols. I-III, U.S. Air Force, Aug. 1964. (Available from DDC as AD 607 533, AD 607 408, and AD 607 409.)

PREDICT is an automated digital computer program for determining transient circuit response which will accept a topological description of a large circuit, evolve and solve the necessary circuit equations, and produce the time history of specified voltages and currents. Transistors, diodes, and capacitors in transient radiation environments must be represented by equivalent circuits composed of combinations of R, L, C, and current and voltage sources.

TREAT is a system of six programs for the automatic processing of data on the effects of transient and steady-state radiation on transistor, diode, and capacitor parameters. The program treats actual and typical device information, evaluates permanent damage to devices, and processes dosimetry information. From actual or typical radiation environment and device data, the theoretical response of certain important device parameters during irradiation can be computed. This output of TREAT can be used directly as an input to PREDICT.

111. Malmberg, Allan F.; Cornwell, Fred L.; and Hofer, Florian N.: NET-1 Network Analysis Program – 7090/94 Version. LA-3119 (Contract W-7405-ENG. 36), Los Alamos Sci. Lab., Univ. of California, Sept. 16, 1964.

NET-1 is a digital computer program which simulates the dc steady-state and the transient behavior of a large class of electrical circuits which may contain passive and active components. It features a very simple input language.

112. Mark, Donald G.: A New Design Tool: The Matched Characteristic Method of Nonlinear Analysis. IEEE, Trans. Aerospace, vol. 2, no. 2, Apr. 1964, pp. 312-317.

The approach presented permits the base and collector characteristics of any individual transistor of a given type to be derived from the nominal characteristics of that type by use of a set of matching factors and terms that modify the nominal characteristics to suit that individual.

113. Nitzan, D.; and Hesterman, V. W.: Flux Switching in Multipath Cores. Rept. 3 (Contracts NASw-6 and JPL-950095), Stanford Res. Inst., June 1964.

A large portion of the work described in this report covers the application of the improved parabolic model to numerical analysis of magnetic circuit problems. All of the computations have been performed on a digital computer, using ALGOL-60. This report includes detailed descriptions of the methods of making computations and the computer programs for solving magnetic-circuit problems.

114. Nuspl, Stephen John: An Incremental Charge Method for the Analysis of Nonlinear Circuits. Rept. No. 166 (Contract Nonr-1834(15)), Digital Computer Lab., Univ. of Illinois, Aug. 6, 1964.

A method of circuit analysis is developed in which only Kirchoff's current law is assumed satisfied. Kirchoff's voltage law may be violated and equations are derived for the basic charge distribution and node voltage of a branch. To obtain sufficiently simple numerical formulas, a circuit with a tree-type topology is assumed. Transistors, diodes, and transmission lines are considered and a program is written to demonstrate the method.

115. Pottle, C.: On the Partial Fraction Expansion of a Rational Function With Multiple Poles by Digital Computer. IEEE, Trans. Circuit Theory (Correspondence), vol. CT-11, no. 1, Mar. 1964, pp. 161-162.

This paper describes an iterative method for performing the partial fraction expansion of a rational function. The scheme is especially designed for computer use.

116. Rippy, Don E.: MAGIC – A Machine for Automatic Graphics Interface to a Computer. NBS Rept. 8665 (NASA CR 62 897), Dec. 29, 1964.

This report describes a machine which has been developed as a research tool for the investigation of man-machine communication techniques. This machine has been designated MAGIC (Machine for Automatic Graphics Interface to a Computer). This machine combines large-diameter cathode-ray displays with a specially designed programable digital computer. It is designed as a remote display station and is intended to be connected to a large ADP system via communication lines.

117. Scheibe, Paul: Composite Report on Problems of Special Interest to the EW Intelligence Efforts. EDL-M636 (Contract DA-36-039-AMC-00088(E)), Sylvania Elec. Prod., Inc., Mar. 23, 1964. (Available from DDC as AD 447 974.)

The section of interest lists some computer routines for circuit analysis and synthesis procedures. They include such techniques as continued fraction expansion and rational function evaluation.

118. Schorr, Herbert: Computer-Aided Digital System Design and Analysis Using a Register Transfer Language. IEEE, Trans. Electron. Computers, vol. EC-13, no. 6, Dec. 1964, pp. 730-737.

This paper presents the results of an attempt to automate part of a formalized method of system design. To illustrate, a register transfer language is used to give a description of an adder considered as part of a digital system. This description is then translated into a set of Boolean equations.

119. Silvernale, L. P.; Kennedy, N. H.; and Wells, A. T.: Computer Aids for Worst Case Electronic Circuit Design. GD/A-BTD-64-113 (Contract NAS3-3232), Gen. Dyn./Astronaut., June 15, 1964.

This paper describes several methods of designing switching circuits and optimizing these designs with a digital computer as a design tool. A method of examining the on-off equation plot of an inverter switching circuit is discussed, and a technique for minimizing output load current and the fan-out factor for an inverter circuit is also presented.

120. Wirth, J. L.: The Design and Analysis of Electronic Circuits by Digital Computers. SC-R-64-1355 (Contract AT(29-1)-789), Sandia Corp., Oct. 1964.

The role of the digital computer in the design and analysis of electronic circuits is discussed with special attention given to the steady-state and transient nuclear environment. Examples are presented which illustrate the usage capability and limitations of

several existing analysis programs. The current direction of research and programing efforts in the area of automatic circuit analysis programs is also considered.

1965

121. Anon.: Part I – Computer-Aided Electronic Circuit Design. Rept. ESL-SR-256 (NASA Res. Grant NsG-496), Massachusetts Inst. Technol., Dec. 1965.

This paper relates to a research program in electronic-circuit design through use of on-line time-shared computers. Several developments pertaining to computer programs designated as CIRCAL are described.

122. Anon.: 1620 Electronic Circuit Analysis Program (ECAP) (1620-EE-02X) – User's Manual. H20-0170, IBM Corp., c.1965.

The IBM 1620 Electronic Circuit Analysis Program (known as ECAP) is an integrated system of programs which can be used by the electrical engineer in the design and analysis of electronic circuits. The system of programs can produce dc, ac, and/or transient analyses of electrical networks from a description of the connections of the network (the circuit topology), a list of corresponding circuit element values, a selection of the type of analysis desired, a description of the circuit excitation, and a list of the output desired.

123. Calahan, D. A.: Computer Design of Linear Frequency Selective Networks. Proc. IEEE, vol. 53, no. 11, Nov. 1965, pp. 1701-1706.

An algorithm is proposed for the computer synthesis of linear networks of arbitrary configuration. In the process, positive elements may be "grown" across nodes as required, or may be forced to desired values. Examples in the areas of passive and active filter design are given, and limitations of the procedure are discussed.

124. Dertouzos, Michael L.; and Therrien, Charles W.: CIRCAL: On-Line Analysis of Electronic Networks. Rept. ESL-R-248 (NASA Res. Grant NsG-496), Massachusetts Inst. Technol., Oct. 1965.

A method is presented for the on-line simulation of electrical networks. The network is described to the computer either by typing elements and nodes to which they connect or by composing the network with a light pen on a cathode ray tube.

125. Dertouzos, Michael L.; and Santos, Paul J., Jr.: CADD: On-Line Synthesis of Logic Circuits. Rept. ESL-R-253 (NASA Res. Grant NsG-496), Massachusetts Inst. Technol., Dec. 1965.

The system described in this paper gives solutions to the general problem by use of an on-line process (using Project MAC at M.I.T.) in which the machine accomplishes those computational tasks which can be algorithmically specified and the user provides those decisions which he is better qualified to make.

126. Fairbrother, L. R.; and Bassett, H. G.: A Computer Program for Analysing Networks Containing Three-Terminal Active Devices Characterized by Their Two-Port Parameters. Radio Electron. Engr., vol. 29, no. 2, Feb. 1965, pp. 85-92.

This paper describes a general-purpose computer program which may be used to calculate the performance of a wide variety of two-port networks. The program is written in Elliott 803 Autocode and can analyze a large feedback amplifier in a few minutes.

127. Fisch, S. M.; and Brigida, G. R.: Computer Algorithm for Fault Isolation and Test Point Selection. AFAPL-TR-65-12, U.S. Air Force, [1965]. (Available from DDC as AD 613 960.)

This report presents the methods and results of a study to develop a computer algorithm for automatically selecting test point locations in an electronic circuit for generating test measurements, and for designing a corresponding test procedure.

128. Geffe, Philip R., ed.: Computer Program Reviews. IEEE, Trans. Circuit Theory, vol. CT-12, no. 2, June 1965, p. 301.

Reviews of the following computer programs are given:

(1) Rips, E. M.: Calculation of Poles and Zeros of Amplifier Transfer Function.

(2) Calahan, D. A.: A General Linear Network Synthesis Program for a Digital Computer.

(3) Domb, U.; and Shen, M. N.: IBM Dasher Synthesis Program.

(4) Chai, D. T.; and DiGiuseppe, J. L.: A SNOBOL Program for the Computation of Circuit Impedance Formulae.

129. Goldberg, M. J.: Network Analysis by Computer. Instr. Control Syst., vol. 38, no. 9, Sept. 1965, pp. 175-178.

This article is primarily a description of the IBM 1620 Electronic Circuit Analysis Program (ECAP). Some extensions of the program are included. See entry 135.

130. Golden, Roger M.: Digital Computer Simulation of Communication Systems Using the Block Diagram Compiler: BLODIB. Proceedings Third Annual Allerton Conference on Circuit and System Theory, M. E. Van Valkenburg, ed., Univ. of Illinois, 1965, pp. 690-707.

Digital computer simulation of communication systems is accomplished by means of the system oriented programing language called BLODIB (Block Diagram Compiler, B). The use of BLODIB is demonstrated by its application in the simulation of a voice-coding system.

131. Hoppe, Roger K.: Maximization of System Reliability Using a Digital Computer and Oscilloscope Search Techniques. M.S. Thesis, State Univ. of Iowa, Jan. 1965. (Available from DDC as AD 611 566.)

The purpose of this paper is to devise a systematic method of searching for the optimal Lagrange multiplier through the use of a digital computer in a direct tie with an on-line oscilloscope.

132. Katzenelson, Jacob; and Seitelman, Leon H.: An Iterative Method for Solution of Nonlinear Resistor Networks. Proceedings Third Annual Allerton Conference on Circuit and System Theory, M. E. Van Valkenburg, ed., Univ. of Illinois, 1965, pp. 647-658.

A direct iteration method for solving networks composed of independent sources and nonlinear resistors is developed. The computer program which was written to implement this method is discussed in the second part of this article.

133. Korn, Granino A.; Conant, Brian K.; Whigham, Robert H.; and Mitchell, Baker Adams, Jr.: Hybrid Computer Monte-Carlo Techniques. EES Rept. No. 9 (NASA Res. Grant NsG-646), Univ. of Arizona, [1965].

Hybrid analog-digital computer systems suitable for high-speed Monte Carlo studies are introduced and methods for reducing the computing time – such as, sequential estimation and a number of variance reducing techniques – are suggested.

134. Lee, Samuel Chien-hsun: Network Synthesis To Minimize Multiparameter Sensitivity. R-262 (Contract DA-28-043-AMC-00073(E)), Coordinated Sci. Lab., Univ. of Illinois, Aug. 1965. (Available from DDC as AD 619 726.)

The concept of sensitivity group is introduced in giving a new definition of multiparameter sensitivity. This new definition makes it possible to compare two RLC networks of different topology which have the same network functions with respect to multiparameter sensitivity. Numerical examples computed on CDC 1604 and IBM 7094 are given to illustrate the method.

135. Liou, M. L.: A Numerical Solution of Linear Time-Invariant Systems. Proceedings Third Annual Allerton Conference on Circuit and System Theory, M. E. Van Valkenburg, ed., Univ. of Illinois, 1965, pp. 669-676.

In this paper, a different recursive formula for the solution of sets of linear differential equations with constant coefficients is derived together with the error expression. It requires even less calculation than previous methods under similar conditions.

136. Mah, L.; Buchsbaum, L.; and Hannom, T. J. B.: Investigation of Fault Diagnosis by Computational Methods for Microcircuits. AFAPL-TR-65-111, U.S. Air Force, Nov. 1965. (Available from DDC as AD 623 957.)

This report describes the computational techniques formulated to extend the methods of automatically isolating faults in electronic circuitry to the level of micromodule. All equations are computer generated. Three diagnostic techniques are implemented.

137. Pottle, Christopher: Comprehensive Active Network Analysis by Digital Computer – A State-Space Approach. Proceedings Third Annual Allerton Conference on Circuit and System Theory, M. E. Van Valkenburg, ed., Univ. of Illinois, 1965, pp. 659-668.

This paper presents the basis of a comprehensive computer analysis program using the A-matrix for general active networks. The advantages of this approach include the capability of obtaining several network functions simultaneously, of working in either the time or frequency domain, and of adjusting parameters without recalculation of the entire network.

138. Preston, Frank S.; Spitalny, Arnold; Mann, William S., et al.: Development of Techniques for Automatic Manufacture of Integral Circuits. AFML-TR-65-386-Vols I-II, U.S. Air Force, Nov. 1965.

Operation of the prototype system was tested by the analysis and layout of a new type of microelectronic IF amplifier. The circuit was then manufactured in a single fabrication run, and exhibited excellent performance. Included herein are the results of related investigations in circuit synthesis, automatic mask production, and statistical system simulation.

139. Skwirzynski, J. K.: The Use of Digital Computers for Network Analysis. Marconi Rev., vol. XXVIII, no. 158, Third Quarter 1965, pp. 195-209.

A speculative discussion is given in this article which distinguishes types of networks occurring commonly in electrical communications equipment. Classical methods of analysis are reviewed and their limitations are stressed. Approximate procedures

and perturbation methods are suggested. Methods are reviewed for inclusion of stray components, parasitic dissipation, accidental modes of oscillations, and so forth. Bibliographical data of recently published material is included.

140. Smith, B. R.; and Temes, G. C.: An Iterative Approximation Procedure for Automatic Filter Synthesis. IEEE, Trans. Circuit Theory, vol. CT-12, no. 1, Mar. 1965, pp. 107-112.

This paper describes an iterative approximation process for the synthesis of low-pass and band-pass filters. The process is very fast and its programed version fits into a 40 000-position computer memory. A brief analysis of the optimality and convergence of the procedure is included. The actual computer programs are described and some examples given.

141. So, H. C.: Analysis and Design of Linear Networks With Adjustable Parameters Using On-line Simulation. Proceedings Third Annual Allerton Conference on Circuit and System Theory, M. E. Van Valkenburg, ed., Univ. of Illinois, 1965, pp. 634-646.

The process of iterative design of large linear networks with multiple adjustable parameters is examined. An experimental on-line computing system is described. Use of the system for iterative design is illustrated. A program using the hybrid matrix technique for circuit analysis is discussed. Examples demonstrating the greater efficiency of the new analysis technique are given.

142. Stahl, Walter J.; McBride, Thomas K.; Maenpaa, John H.; et al.: Investigation of Fault Diagnosis by Transfer Function Techniques. AFAPL-TR-65-113, U.S. Air Force, Nov. 1965. (Available from DDC as AD 625 587.)

This paper demonstrates the feasibility of using amplitude and break-point frequency changes to locate faults at the component level for linear circuits. A computer program has been written to obtain a dictionary of symptoms and their correlations with faulty components.

143. Stineman, R. W.: Digital Time-Domain Analysis of Systems With Widely Separated Poles. J. Assoc. Computing Machinery, vol. 12, no. 2, Apr. 1965, pp. 286-293.

The digital computer program described in this document has been developed for the time-domain analysis of control systems and electric or electronic networks. The program employs a special method of numerical integration which is capable of economically generating a solution for a system having a wide range of time constants or natural frequencies.

144. Thomas, W. J.: Transient Analysis Generator (TAG). Contract No. NAS 7-100, Jet Propulsion Lab., California Inst. Technol., c.1965.

The Transient Analysis Generator (TAG) produces a FORTRAN (II 7094) program which will perform a linear or nonlinear analysis of an electrical network. The analysis done is either transient or dc. There are no restrictions on the interconnections of the elements that do not also exist in the physical world. Special devices such as transistors, diodes, and real transformers must be represented by equivalent circuits (models). The user is free to replace special devices with the model of his choice.

145. Thomson, D.: General Circuit Analysis by Computer – An Aid to Wideband Negative-Feedback-Amplifier Design. Electron. Letters, vol. 1, no. 4, June 1965, pp. 101-102.

A computer fed with measured component data calculates all external properties of the amplifier and Bode's return ratios for the active elements to permit examination of stability. An amplifier constructed to check the method is described and discussed.

146. Turpin, Larry M.: CODED Circuit Analysis. Volume I: Instruction Manual for DC-AC Applications. NAFI-TR-544, U.S. Navy, Sept. 6, 1965. (Available from DDC as AD 628 110.)

This report contains information about the Computer Oriented Design of Electronic Devices (CODED) Circuit Analysis programs: procedures for their use, applications, capabilities, limitations, and examples. Two of the CODED programs discussed in this report are for ac analysis and two for dc analysis.

147. Waren, A. D.; and Lasdon, L. S.: Practical Filter Design Using Mathematical Optimization. Proceedings Third Annual Allerton Conference on Circuit and System Theory, M. E. Van Valkenburg, ed., Univ. of Illinois, 1965, pp. 677-689.

This paper proposes a solution to the problem of designing a filter of given structure, incorporating nonideal elements, to meet or exceed given insertion loss specifications subject to element value bounds. The overall method is especially amenable to computer implementation. The techniques presented have been applied to the computer design of cascade crystal-realizable lattice filters. Some results are presented.

148. Weindling, M. N.: Computer Automated Design Techniques in the Future of Aerospace Electronics. 1965 Proceedings National Aerospace Electronics Conference, IEEE, May 1965, pp. 25-31.

The description of a partially implemented automatic design system in which the definition of the functional processes of the electronics system is translated by a

computer program into a set of logic equations is presented. Boolean minimization, timing considerations, and component-selection techniques are discussed.

149. Willcox, B. A. M.; and Macario, R. C. V.: Iterative Procedure for Analysing Certain Networks by Digital Computer. Proc. Inst. Elec. Engrs. (London), vol. 112, no. 12, Dec. 1965, pp. 2243-2253.

The paper describes and illustrates a method of analyzing linear electrical networks which can be viewed as a set of interconnected four-terminal networks. The paper also outlines a program which has been written for the method.

150. Yang, Tsute: A Bibliography on Digital Computer-Aided Circuit Analysis and Design. NASA Grant NGR-39-023-004, Villanova Univ. [1965].

This bibliography lists pertinent literature on computer-aided techniques and programs directly connected with circuit analysis and design. The entries are arranged alphabetically by author, and a subject index and a chronological index are appended.

151. Zucker, M. S.: LOCS: An EDP Machine Logic and Control Simulator. IEEE, Trans. Electron. Computers, vol. EC-14, no. 3, June 1965, pp. 403-416.

This paper describes the LOCS System with a description of LOCS inputs and outputs as well as an outline of the procedure one must follow to use LOCS. The method of using LOCS is illustrated by an example of the complete simulation of a simple conventional binary data processing machine. Also, a summary of current status is given.

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152. Branin, Franklin H., Jr.: A New Method for Steady State A-C Analysis of RLC Networks. IEEE Intern. Conv. Record, vol. 14, pt. 7, 1966, pp. 218-223.

A new method is described for steady state ac analysis of RLC networks on a digital computer. This method provides a more efficient way of computing frequency response than the usual method of solving linear equations at each new frequency. The new method also leads to simple formulas for the response functions of the network as partial fraction expansions and for their sensitivities with respect to frequency and/or component variations.

153. Falk, Howard: Computer Programs for Circuit Design. Electro-Technol. (New York), vol. 77, no. 6, June 1966, pp. 54-57.

This paper presents a description of 25 computer programs for circuit analysis and design. See also entry 105.

154. Kuo, F. F.: Network Analysis by Digital Computer. Proc. IEEE, vol. 54, no. 6, June 1966, pp. 820-829.

This article gives a brief survey of various methods for network analysis by digital computer. Topics discussed include methods and programs for ladder networks, mesh and nodal analysis, network topology, electronic circuit analysis, state-variable analysis, n-port hybrid matrix analysis, and nonlinear circuit analysis. Also given is a brief discussion concerning algorithms for inverse Laplace transformation and methods for obtaining magnitude, phase, and delay responses in the frequency domain.

155. Liou, M. L.: Novel Method of Evaluating Transient Response. Proc. IEEE, vol. 54, no. 1, Jan. 1966, pp. 20-23.

In this paper, a method of evaluating transient responses of linear time-invariant systems using the state space approach is described. Given the Laplace transform of the response function as a ratio of two polynomials in the complex frequency of proper form, the corresponding linear state space equation is formulated. A recursive formula for the transient response is derived from the exact solution of the state space equation. Numerical solutions can be obtained for any desired interval of the response time.

156. Shalla, Leon: Automatic Analysis of Electronic Digital Circuits Using List Processing. Commun. ACM, vol. 9, no. 5, May 1966, pp. 372-380.

A mapping from block diagrams of digital circuits to list structures is described, together with a list processing program written for the Control Data 3600 which uses this mapping to automatically carry out circuit analysis.

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