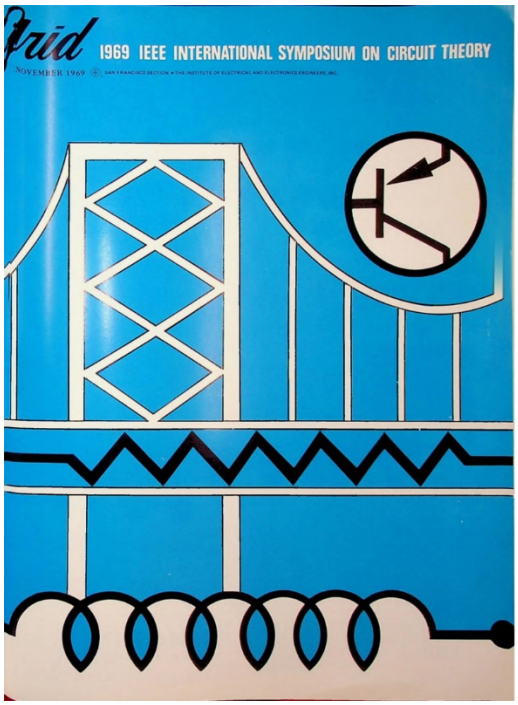
EDITOR'S PROFILE of this issue

from a historical perspective …

with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)



November, 1969:

Cover: The International Symposium on Circuit Theory will be in S.F. in December. Details on pages 6-8.

Page 6: Leon Chua of Purdue speaks on lumped circuit models. He later joins UC-Berkeley and postulates in a paper in 1971 that, citing the symmetry of the Kirchoff equations, there should be a fourth circuit element beyond the resistor, capacitor and inductor, calling it the memristor (a memory resistance). Not until devices approach the nano-level do researchers assign anomalous behavior to this effect. Stan Williams of HP Labs is able to create the solid-state memristor. I was one of Stan's Fellow endorsers.

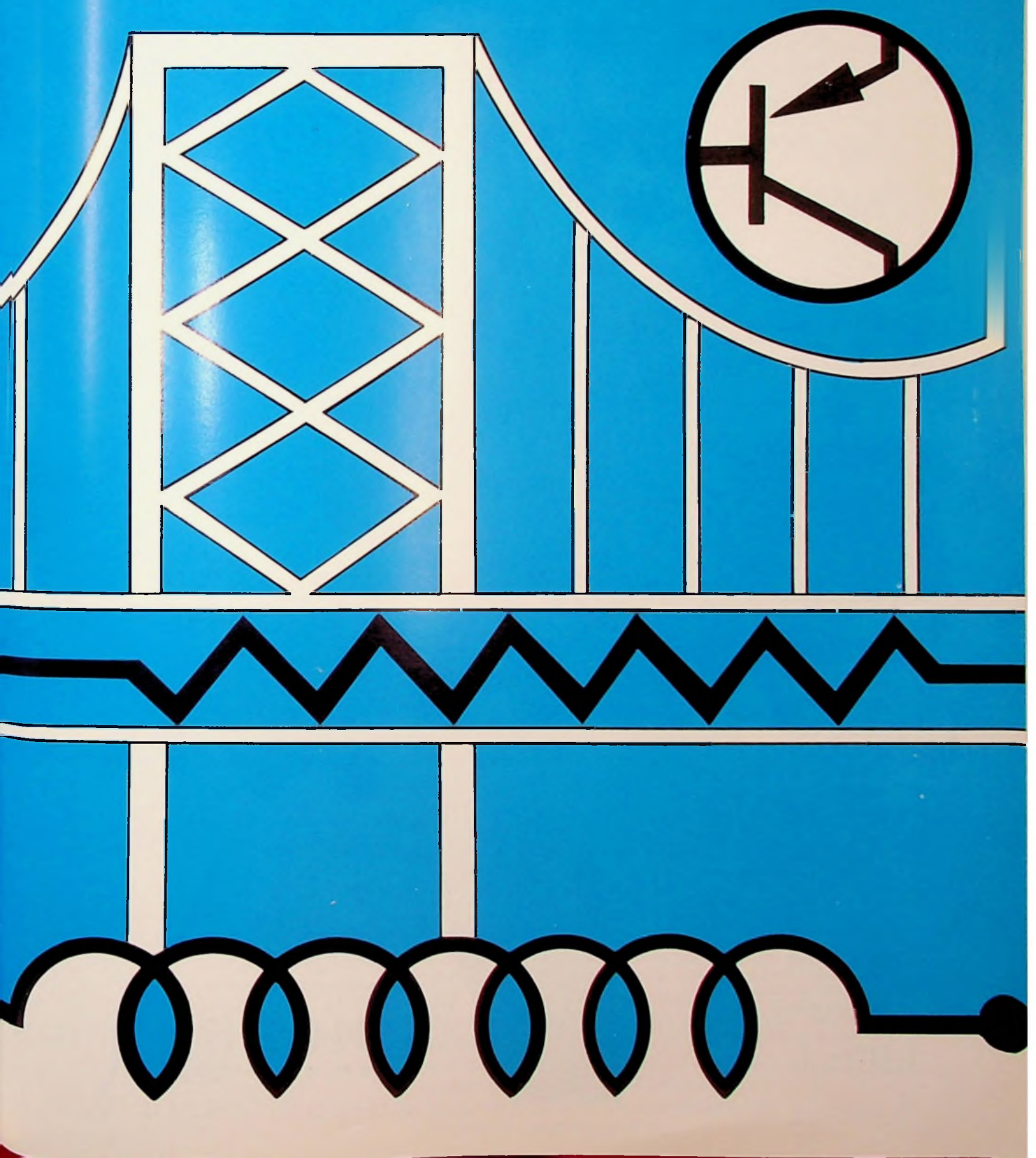
Page 10: Bob Widlar, the key analog IC designer from National Semiconductor, gives a talk on new line drivers and receivers for DTL/TTL circuits.

Page 11: Andy Grove of Intel gives his "prejudiced view" on LSI technology. He'll discuss new chip technologies and packaging approaches.

Page 14: Andy Bobeck of Bell Labs gives a talk about magnetic domain ("bubble") devices and how they can be used for computer memeory. This is a magnetic "dual" of recently-developed charge-coupled devices. Several years later, when I was at disk drive company Information Storage Systems (ISS), the "common knowledge" was that bubble memory would replace disk drives. Several of us traveled to Bell Labs to discuss this technology with Andy and his staff; we then hired a young engineer from Bell Labs, Ari Kurtzig, to head up an ISS effort. I was in charge of liquid phase epitaxy and electronic evaluation. Once we achieved our own capability, we "put it on the shelf" in case we needed to put it into production. Of course, disk drives kept getting better and cheaper, so we never returned to the bubbles. My wife and I advised Ari's wife Sandra that our Valley would be a good place for her to take a chance and start a software company she had in mind. She started ASK Computer (ASK stands for Ari and Sandra Kurtzig), becoming an early woman tech entrepreneur, selling her company with revenues of nearly $1 billion in 1994.

Grid
NOVEMBER 1969 SAN FRANCISCO SECTION • THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

1969 IEEE INTERNATIONAL SYMPOSIUM ON CIRCUIT THEORY



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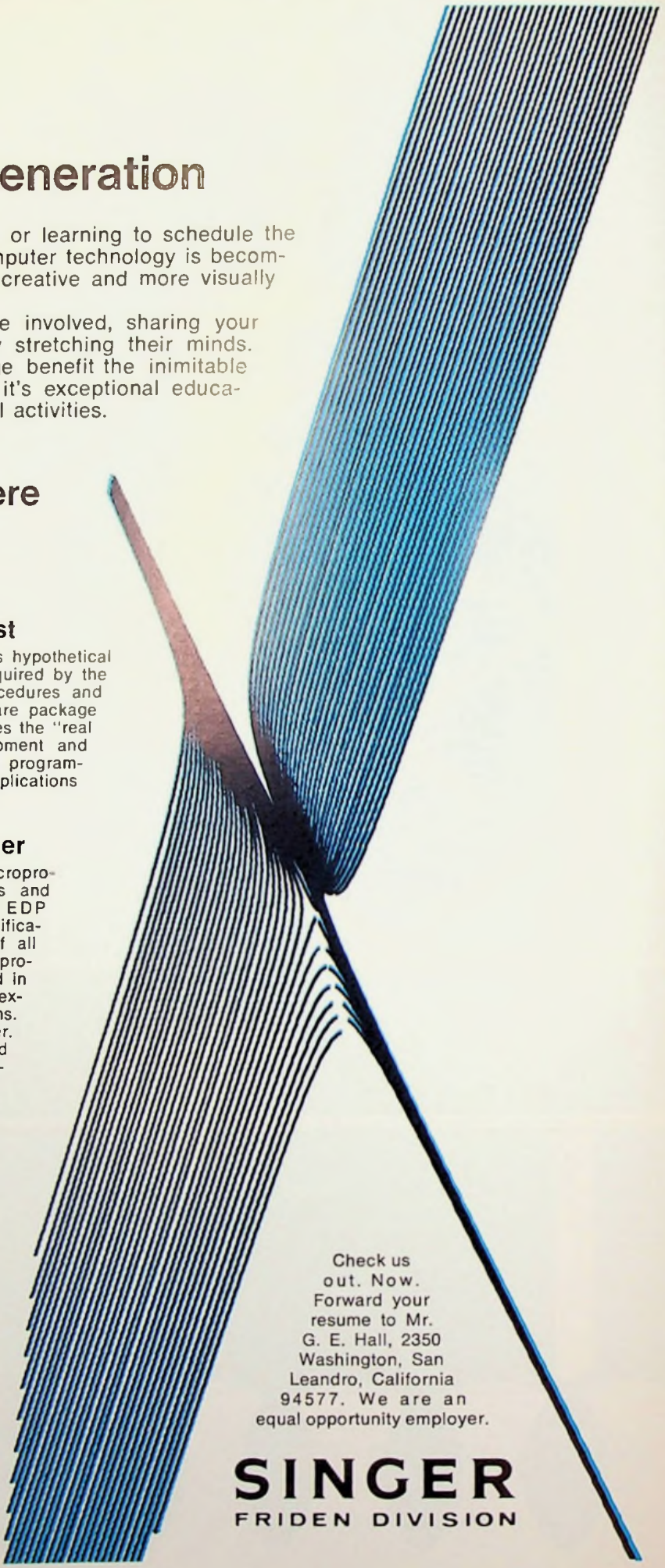

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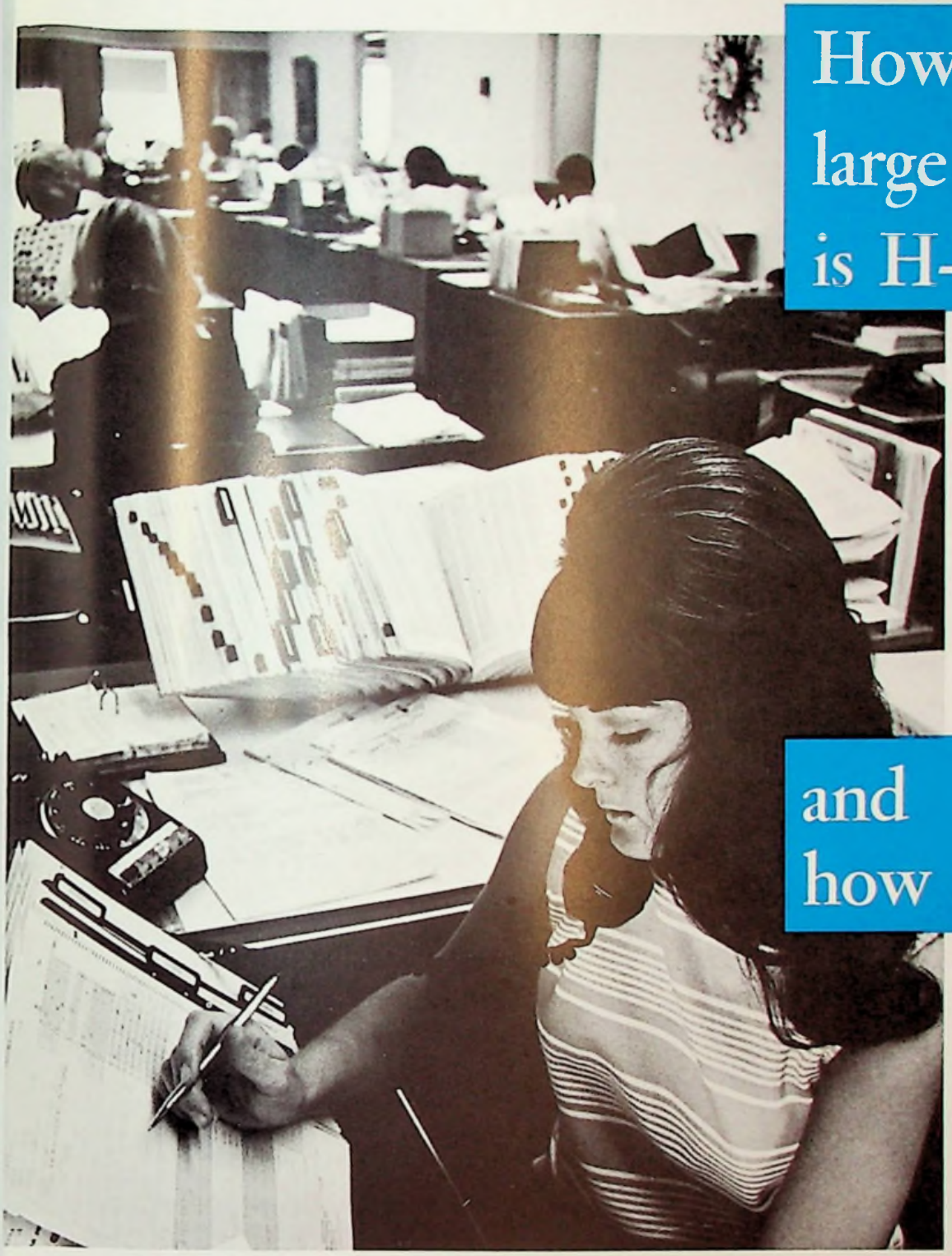

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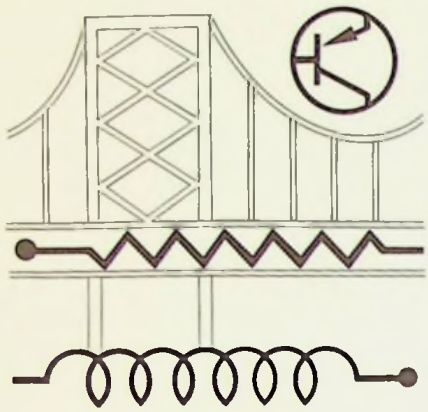
Grid 1969 IEEE INTERNATIONAL SYMPOSIUM ON CIRCUIT THEORY



San Francisco hosts the 1969 International Symposium on Circuit Theory, December 8-10, at the Mark Hopkins Hotel. Artist Nanci Chin's cover design depicts Circuit Networks and Systems Symbols around the Golden Gate Bridge. The Symposium Program will be found on pages 6, 7 and 8. The Chairman's Message (on page 4) concerns itself with this important IEEE-sponsored event.

Grid

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number 3

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MEETING CALENDAR

ANTENNAS & PROPAGATION
NOV. 19

Story on page 4

APPLICATION OF NUMERICAL INTEGRAL EQUATION TECHNIQUES FOR SOLVING GENERAL ANTENNA AND SCATTERING PROBLEMS. Second in a series of Tutorial lectures on COMPUTER AIDED DESIGN. Dr. Mogens Andreasen, Technology for Communications International, Mountain View.

NOV. 19, Wednesday, 8:00 PM, Philco-Ford Bldg. 56, Cafeteria Conference Room. Dinner: 6:00 PM, Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. No Reservations.

AUDIO & ELECTROACOUSTICS
NOV. 21

FALL KICKOFF MEETING. Ladies and guests invited. A 20-minute pre-show lecture by the audio engineer at the Circle Star Theatre. The show will be a musical to be announced. Come enjoy a "night on the Town"!

NOV. 21, Friday, 7:30 PM, Circle Star Theatre, Whipple Rd. & Bayshore, San Carlos. Dinner: 6:00 PM at the theatre in Tommy Haller's Celebrity Room. Show tickets are $4.50, and Italian family style dinner $4.50 each person. For reservations for both show and dinner, call Miss Ralston at 734-2910 by Nov. 7th.

AUTOMATIC CONTROL
NOV. 18

Story on page 8

COMPUTER CONTROL FOR ECONOMIC DEVELOPMENT. Dr. Otto J. M. Smith, University of Calif., Berkeley.

NOV. 18, Tuesday, 8:00 PM, Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto. Dinner: 6:30 PM, Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. No reservations.

CIRCUIT THEORY
NOV. 19

Story on page 14

STABILIZATION AND LINEARIZATION WITH COMPLEMENTARY ACTIVE FEEDBACK. George C. Sziklai, Senior Consulting Scientist, Lockheed M & S Co., Palo Alto.

NOV. 19, Wednesday, 8:00 PM, 134 McCullough Hall, Stanford University. Dinner: 6:15 PM, Stickney's Hickory House, El Camino Real & Embarcadero, Palo Alto. Reservations: Section Office: 327-6622 by Nov. 18th.

ELECTROMAGNETIC COMPATIBILITY
NOV. 17

Story on page 10

INTEGRATED CIRCUITS FOR DIGITAL DATA TRANSMISSION. Robert J. Widlar, Director of Advanced Circuit Development, National Semiconductor Corp., Santa Clara.

NOV. 17, Monday, 8:00 PM, Hewlett-Packard Auditorium, 1501 Page Mill Rd., Palo Alto. Dinner: 6:00 PM, Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto. Reservations: Paul Gagner, 969-1050 by noon, Nov. 17th.

GOLDEN GATE SUBSECTION
NOV. 26

Story on page 12

RECENT DEVELOPMENTS OF STATIC NO-BREAK POWER FOR CRITICAL LOADS. Moon Yuen, Assistant Chief Electrical Engineer, Chemical & Refining Div. Bechtel Corp. and David C. Griffith, Manager Cyberex Corp., Willoughby, Ohio.

NOV. 26, Wednesday, 8:00 PM, Engineers Club, 160 Sansome St., San Francisco. Cocktails: 6:00 PM; dinner 7:00 PM. Reservations: 421-3184 by Nov. 25th.

ELECTRON DEVICES
NOV. 20

Story on page 11

LSI TECHNOLOGY — A PREJUDICED VIEW. Dr. Andrew S. Grove, Director of Operations, Intel Corp., Mountain View.

NOV. 20, Thursday, 8:00 PM, Rick's Swiss Chalet, 4085 El Camino Way,

Palo Alto. Cocktails: 6:00 PM; dinner 7:00 PM. Reservations: Section Office — 327-6622.

ENGINEERING MANAGEMENT
NOV. 12

Story on page 12

COMMUNICATIONS. Dr. Witold Krassowski, University of Santa Clara. Wives and guests invited.

NOV. 12, Wednesday, 8:00 PM, Kozy Grotto, 210 Hope St., Mt. View (across from the Post Office). Dinner 6:00 PM. No reservations.

INFORMATION THEORY
NOV. 20

Story on page 4

SEQUENTIAL DECODING OF TELEMETRY DATA FROM PIONEER IX. Dr. Dale R. Lumb, Research Scientist, Ames Research Center, Moffett Field.

NOV. 20, Thursday, 8:30 PM, Stanford Research Institute, Bldg. 1, 333 Ravenswood Ave., Menlo Park. Dinner: 6:15 PM, L'Omelette, 4170 El Camino Real, Palo Alto. Reservations: Mrs. Mary Rodimon — 966-2092 by Nov. 19th.

MAGNETICS
NOV. 17

Story on page 14

BUBBLE DOMAIN DEVICES — A NEW APPROACH TO MEMORY AND LOGIC. Andrew H. Bobeck, member technical staff, Bell Telephone Lab.

NOV. 17, Monday, 8:00 PM, IBM Education and Training Center, Bldg. 010, Monterey & Cottle Rds., San Jose. No dinner.

MICROWAVE THEORY & TECHNIQUES
NOV. 12

Story on page 10

A PROGRAM ON SLOT-LINE, A PROMISING IC TECHNIQUE. Dr. Seymour B. Cohn, independent consultant and Keith Hunton, Sylvania Electronic Systems.

NOV. 12, Wednesday, 8:00 PM, SRI Bldg. 44, Room 124, Laurel St., Menlo Park. Cocktails: 5:30 PM; dinner 6:00 PM, Dinah's Shack, El Camino Real, Palo Alto. Reservations: Dianna Bremer, 326-6200, ext. 3765 by Nov. 11th.

PARTS, MATERIALS & PACKAGING
NOV. 25

COMPUTER CONTROLLED PRODUCT TESTING. Dale Ewy, Development Engineering Manager, Hewlett-Packard Systems Div.

NOV. 25, Tuesday, 7:30 PM, Hewlett-Packard Auditorium, 1501 Page Mill Rd., Palo Alto. No dinner.

RELIABILITY
NOV. 13

Story on page 13

ELECTRONIC PARTS AND LONG DISTANCE SPACE MISSIONS. Warren G. Lockyear, Manager of Electronic Parts Engineering at JPL.

NOV. 13, Thursday, 8:00 PM, PH 104, Stanford University. Dinner: 6:00 PM — "Meet the Speaker" — Stanford View Restaurant, El Camino, Palo Alto. Reservations: G. Bowers, 962-4111 or Lew Finch, 743-1577 by Nov. 12th.

SANTA CLARA VALLEY SUBSECTION
NOV. 19

Story on page 16

THE ENVIRONMENTAL SCIENCES INSTITUTE OF SAN JOSE STATE COLLEGE — WHAT IT IS — WHERE IT IS GOING. Dr. J. Y. Wang, Director of the Institute.

NOV. 19, Wednesday, 8:00 PM, Berry Farm, 2825 El Camino, Santa Clara. Dinner: 7:00 PM. Reservations: Section Office — 327-6622 by Nov. 14th.

VEHICULAR TECHNOLOGY/ COMMUNICATION TECHNOLOGY
NOV. 17

Story on page 4

JOINT MEETING. FIELD TOUR OF BART CONTROL CENTER, LAKE MERRITT STATION. John Andrews, Bay Area Rapid Transit District, San Francisco.

NOV. 17, Monday, 6:30 PM, Lake Merritt Station, 8th & Oak St., Oakland. Meeting starts at 6:30, dinner at 7:30 PM. Reservations: Bill Nye, 328-1200; Al Isberg, 433-3800, or Paul Ahern, 291-4415 by 4:30 PM, Nov. 14th.

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Chairman's Message

San Francisco is not only everybody's favorite city, but it is also an ideal place for a Symposium of Circuit Theorists from throughout the world. The San Francisco area universities provide active leadership in exploring new circuit theoretic concepts and ideas; the industry in this area on the other hand, designs and manufactures circuits ranging over a wide spectrum from filters to integrated circuits.

The industry-university communication is achieved by a balanced mix of distinguished researchers and practitioners of the art of circuit design represented on the program. Many panel discussions will be devoted to searching questions on the outstanding major problems in Circuit Theory. A special item of general interest is a panel discussion on the Relevance of Circuit Theory to the problems confronting modern society. The panel will attempt to answer questions on how the focus of circuit theory can be broadened to admit a more constructive participation in modern technological society.

All in all, the Symposium issues a challenging call to all people interested in electronic circuits as well as to circuit theorists in the San Francisco area. On behalf of the San Francisco Section of IEEE, I want to welcome the Symposium and wish Bharat Kinariwala its chairman, the greatest success.

John B. Damonte, Chairman
IEEE, San Francisco Section

Comtech & Vehicular Tech Offer 2nd Joint Meeting

Nearly everyone has heard of BART and their need to advance the state of the art in communications and controls for their transit system. This CTG/VTG field trip will offer a personal tour of BART's computer dispatch control center at their Lake Merritt station by John Andrews, Senior Engineer, Development and Operations Department. Since Mr. Andrews has first-hand knowledge of the control facilities, he can get as technical as you desire. We don't think you'll want to miss it.

This field trip, another joint meeting between the Vehicular Technology Chapter and the Communication Technology Chapter, will begin at 6:30, break for dinner at 7:30. Two short films on the BART system will follow. Reservations required. See Calendar.

Decoding of Telemetry Data from Pioneer IX

The Pioneer IX deep space probe has the telemetry link configured for a commandable coded or uncoded mode of operation. For the past 9 months, Pioneer IX has been operating principally in the coded mode with sequential decoding of a rate 1/2, 25-bit constraint length convolutional code. Dale R. Lumb will discuss performance of the in-flight system at the Information Theory Chapter meeting, November 20, and will compare the results with those from both computer simulations and pre-flight experimental tests. Departure from the ideal independent additive gaussian channel will be shown including the channel memory effect at low data rates. The probability and conditional probability distributions of data into the sequential decoder illustrate these effects and the decoding computation distributions reflect the performance degradation from the ideal channel. Communication range extension equivalent to a 3 dB increase of transmitting power has been verified at all five Pioneer data rates by comparison of coded operation with the simple parity check error detection scheme used in the so-called uncoded mode. In particular, convolutional coding has extended the communication lifetime on the 85-foot Deep Space Station antennas by 5 months.

Dale R. Lumb

Dr. Lumb is a member of IEEE, Phi Kappa Phi, Eta Kappa Nu, and Sigma Tau. He received his B.S. with honors in electrical engineering at Kansas State University in 1958, and his M.S. and Ph.D. from Kansas State in 1959 and 1962, respectively. Since 1963 he has worked on communications problems for the Pioneer missions and coding studies for deep space telemetry applications. In 1964 he became a civilian employee of Ames Research Center. At present he is Principal Investigator on the Telemetry Convolutional Coding Experiment for the Pioneer IX mission.

Application of Numerical Integral Equation Techniques

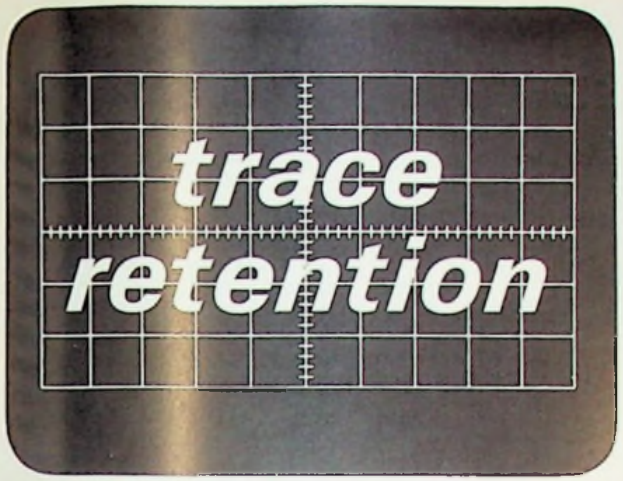
The second in a series of tutorial lectures which are intended to introduce computer-aided design techniques to engineers interested in solving practical electromagnetic design problems will be presented at the Antennas and Propagation Chapter meeting on Wednesday, November 19. The second lecture will be presented by Dr. Mogens Andreasen of Technology for Communications International, Mountain View. Dr. Andreasen will discuss the application of

Dr. Andreasen

the digital computer in the solution of many electromagnetic problems that have traditionally been solvable only by experimental methods. Formulated in terms of integral equations, these problems can be solved with an accuracy and completeness unobtainable by experimental methods, in a small fraction of the time at much less cost than by experiments. Computer programs utilizing these techniques have been developed in the areas of radiation and scattering from general wire-antenna structure, and from bodies of various general shapes. These programs will be described and the generality and accuracy of the programs will be illustrated by numerous examples.

Dr. Andreasen is Manager of Electromagnetic Research at Technology for Communications International, Mountain View. He received his education at the Technical University of Denmark. He has been engaged in solution of electromagnetic problems by digital computer techniques for many years and has published many papers on this subject.

The meeting will be held in the Philco-Ford Building 56 Cafeteria Conference Room at 8:00 PM. Dinner is planned for 6:00 PM at Rick's Swiss Chalet.



the convenience feature

Most waveform measurements are easily made with today's instrumentation. Signals are usually repetitive, medium frequency, sufficient in amplitude, easily triggerable, etc.—usually, but not always. Some signals persist in being single event or low frequency, aperiodic or absolutely random, and even untriggerable. There are three ways to approach these problem measurements: (1) great operator patience, (2) waveform photography, (3) trace retention (storage). The storage technique is pure convenience by comparison.

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1969 CIRCUIT THEORY SYMPOSIUM PROGRAM

MONDAY, DECEMBER 8

8:45 AM Welcoming Address by B. K. Kinariwala, University of Hawaii

9:00 AM Opening Address by A. P. Stern, Magnavox Research Labs

9:45 AM CIRCUIT DESIGN AND THE CIRCUIT THEORIST (Peacock Court)
PANELISTS:
William Howard, Motorola (Moderator)
Barrie Gilbert, Tektronix, Inc.
John Logan, Bell Telephone Labs
Robert Seeds, Fairchild
James Solomon, Motorola

1:30 PM COMPUTATIONAL CIRCUIT ANALYSIS (Peacock Court)

1:30 "Computer Analysis of Nonlinear Networks by Recursive Decomposition," by Michael L. Dertouzos, MIT

2:00 "On the Time Domain Analysis of Linear Time Invariant Networks with Large Time Constant Spreads, by Digital Computer," by Paul M. Russo, University of California, Berkeley

2:15 "The Inverse Laplace Transform of Irrational and Transcendental Transfer Functions via the Fast Fourier Transform," by R. F. Chiu, University of Houston and C. F. Chen, University of Cambridge, England

2:30 "Computation of D.C. Solutions for Bipolar Transistor Networks," by H. Schichman, Bell Telephone Labs

3:00 "Sparse Matrix Exploitation in Circuit Simulation," by M. Blostein, McGill University, Canada

3:00 "Integrated-Circuit Transistor and Diode Models for Network Analysis Programs," by Fred A. Lindholm, University of Florida

3:45 "A Digital Method of Transfer Function Calculation," by D. L. Fletcher and C. N. Weyzandt, Philco-Ford

1:30 PM FILTERS: CONTINUOUS AND DIGITAL (Room of the Dons)

1:30 "On Synthesis of Filters," by J. K. Skwirzynski, Marconi Co., England

2:00 "Design of Piezoelectric Ladder Filters," by F. L. Sauerland, Clevite Corp.

2:15 "Linear Phase Transmission Line Filters with Increased Selectivity," by Branko D. Rakovich

2:30 "On a Filter Approximation Problem," by G. Szentirmai, Cornell University

3:15 "Digital Filters With a Number of Shift Sequences in Each Pulse Repetition Interval," by Tore Fjallbrant, L. M. Ericsson, Sweden

3:45 "Digital Filters for Approximating Continuous Convolutions," by S. R. Harrison and B. J. Leon, Cornell University

4:00 "On Digital Single-Sideband Modulators," by Sidney Darlington, Bell Telephone Labs

4:15 "Effect of Coefficient Rounding in Floating-Point Digital Filters," by Toyohisa Kaneko and Bede Liu, Princeton University

1:30 PM ACTIVE NETWORK SYNTHESIS I (Golden Empire Room

1:30 "A Synthesis Procedure for Gyrators and Related Circuits," by Richard W. Daniels, Bell Telephone Labs

2:00 "Second Order Pole-Zero Pair Selection for Minimum Sensitivity Nth Order Networks," by G. S. Moschytz, Bell Telephone Labs

2:15 "A Decomposition of a Transfer Function Minimizing Sensitivity," by E. Lueder, Bell Telephone Labs

2:30 "The Biquad: A Multipurpose Active Filtering System," by Lee C. Thomas, Bell Telephone Labs

3:15 "Very High Q Insensitive Active RC Networks," by R. Tarmy and M. S. Ghausi, New York University

3:45 "Very Low Sensitivity Canonic Active RC Filters," by M. A. Soderstrand, Sandia Labs and S. K. Mitra, University of California, Davis

4:00 "Novel RC-Active-Network Synthesis Using Generalized Impedance Convertors," by A. Antoniou, Northern Electric Co., Canada

4:15 "Simultaneous Realization of Two Admittance Functions Using One Operational Amplifier," by N. Walter Cox and Kendall L. Su, Georgia Institute of Technology

TUESDAY, DECEMBER 9

9:00 AM ACTIVE FILTERS (Peacock Court)
PANELISTS:
M. S. Ghausi, New York University (Moderator)
A. Grebene, Signetics Corp.
W. Kerwin, University of Arizona
G. S. Moschytz, Bell Telephone Labs
D. O. Pederson, University of California, Berkeley
T. N. Rao, Bell Telephone Labs

9:00 AM NONLINEAR AND TIME-VARIABLE CIRCUITS AND STATE VARIABLE STUDIES (Room of the Dons)

9:00 "Design of Linear Time-Varying and Nonlinear Time-Invariant Networks," by C. A. Desoer and B. Peikari, University of California, Berkeley.

9:30 "State Equation Formulation for Multiport Networks," by R. Saeks, University of Notre Dame

9:45 "Elimination of Zero Eigenvalues of the Transition Matrix in a State Variable Network Description," by R. E. Parkin, Northeastern University

10:00 "On the Irreducible Jordan Form Realization and the Degree of a Rational Matrix," by Y. L. Kuo, Purdue University

10:45 "Synthesis of Lumped Circuit Models for Nonlinear Inductors Exhibiting Hysteresis Loops," by L. O. Chua and K. A. Stromsmoe, Purdue University

11:15 "Pull-In Time in Second Order Phase-Locked Loops With a Sawtooth Comparator," by Emmanuel N. Protonotarios, Columbia University

11:30 "Distortion Analysis for Mixer Diodes Possessing Discontinuous Resistance-Voltage Characteristics," by J. G. Gardiner, D. C. Surana, and A. M. Yousif, University of Bradford, England

11:45 "On the Absolute Stability of a System of Nonlinear Networks Interconnected by Lossless Transmission Lines," by Rui J. P. De Figueiredo and Chen-Yao Ho, Rice University

9:00 AM GRAPH THEORY AND APPLICATIONS (Golden Empire Room)

9:00 "A Graph Theoretical Layout Procedure for Integrated Circuits," by W. L. Engl and D. A. Mlynski, Institut für Theoretische Elektrontechnik, Aachen, Germany

9:30 "An Algorithm for Partitioning Networks into Limited Sets of Different Subnetworks," by D. Ferrari and M. Sami, Istituto di Elettrotecnica ed Elettronica, Italy

9:45 "Degree Synthesis of Antisymmetric Nets," by Jamil K.

Ayoub, University of California, Berkeley

10:00 "Invariance Properties of Central Trees," by Vito Amoia, Istituto di Elettrotecnica ed Elettronica, Politecnico di Milano and G. Cottafava, Istituto di Elettrotecnica, Universita di Pavia, Italy

10:45 "An Efficient Method for Topologically Formulating Network Functions," W. Dunn, Jr., and S. P. Chan, University of Santa Clara

11:15 "Realization of Modified Cut-set Matrix and Applications," by P. Subbarami Reddy, V. G. K. Murti and K. Thulasiraman, Indian Institute of Technology, Madras, India

11:30 "A Proof of Tutte's Realizability Condition," by Wataru Mayeda, University of Texas, Austin

2:00 ACTIVE NETWORK DESIGN CONSIDERATIONS (Room of the Dons)

2:00 "Stability — and Design Criteria for Active Linear Two-Ports, with Generalized Scattering Parameters," By Rafael O. Thore, Belgian Space Aeronomy Institute and Hendrik Van Brussel, University of Louvain, Belgium

2:30 "Simultaneous Realization of Gain and Bandwidth in Transistor Amplifiers," by John Choma, Jr., Sacramento State College

2:45 "A Simple Diode Model Including Conductivity Modulation," by A. Barna and D. Horelick, Stanford Linear Accelerator Center

3:00 "Switching Properties of the Emitter-Coupled Transistor-Pair," by Arpad Barna, Stanford Linear Accelerator Center

3:45 "Noise Measure of an Integrated Negative Impedance Converter," R. G. Hamer, Motorola; J. H. Mulligan, Jr., National Academy of Engineering and S. S. Shamis, New York University

4:00 "Designable Video Amplifiers Using Base-Compensated Stages," by David J. Comer, Chico State College

4:15 "Analysis of Tuned Junction Transistor Circuits Under Large Sinusoidal Voltages in the Normal Domain." Part I: "The Effective Hybrid," by M. A. H. El-Said, Geiza, Cairo, U.A.R.

4:30 Part II: "Equivalent Circuit," by M. A. H. El-Said, Geiza, Cairo, U.A.R. (separate paper)

2:00 PM N-PATH FILTERS (Peacock Court)

2:00 "N-Path Filters — a Tutorial Review," by L. E. Franks, University of Massachusetts

2:25 "Active Switched Bandpass Filters," by G. Szentirmai, Cornell University

2:50 "On Single Sideband Modulation by Spectrum Analysis," by S. Darlington, Bell Telephone Labs

3:45 "Quadrature N-Path Filter," by Y. Sun, University of Wisconsin, Madison

4:10 "A Digital Time Division Multiplexed N-Path System," by A. B. Glasser, Bell Telephone Labs

4:35 "Reliability Conditions and Associated Invariance Relations for N-Path Networks with Sinusoidal Carrier Oscillations," by W. Saraga, General Electric Co., England

2:00 PM DISTRIBUTED NETWORKS (Golden Empire Room)

2:00 "Impedance and Admittance Matrices of Distributed Three-Layer N-Ports," Pier Paolo Civalleri and Sandro Ridella, Istituto Elettrotecnico Nazionale, Italy

2:30 "Transient Behaviour of a Distributed Parameter Transformer," by Vaclav Dvorak, University of Alberta, Canada

2:45 "Synthesis of Cascaded Multiwire Unit Element Networks and Double N-Port," by A. Premoli and P. Soardo, Istituto Elettrotecnico Nazionale, Torino, Italy

3:00 "A Design of Method for Meander Line Networks Using Equivalent Circuit Transformations," by Risaburo Sato, Tohoku University, Japan

3:45 "Cascade Synthesis of Distributed Networks by Lumped Ladder RC Equivalents," by K. K. Pang, University of California, Berkeley

4:00 "Distributed RC Networks with Rational y-Parameters Having Prescribed Poles," S. Y. Hwang, University of North Dakota and W. C. Duesterhoeft, Jr., University of Texas, Austin

4:15 "Time Domain Approximation Using Multilayer RC Distributed Networks," by F. Y. Chang, IBM

4:30 "Distributed RC Filter Networks," by J. O. Scanlan and N. Ramamurty, The University of Leeds, England

WEDNESDAY, DECEMBER 10

9:00 AM CIRCUIT SENSITIVITY AND OPTIMIZATION (Peacock Court)

9:00 "Automated Optimization of Switching Networks Via SCEPTRE Simulation," by C. W. Ho and G. D. Hachtel, IBM

9:30 "Toward Completely Automated Amplifier Design," by A. J. Broderson and S. W. Director, University of Florida

9:45 "Optimal Synthesis of a Distributed RC Circuit," by A. R. Karnik, XEROX Corp. and G. H. Cohen, University of Rochester

10:00 "Optimum Least-Squares Approximations to the Ideal Low Pass Filter," by C. Pottle and J. C. K. Wong, Cornell University

10:45 "About Sensitivity Invariants of Equivalent Networks," by R. de Bude, Canadian General Electric Co.

11:15 "On the Solution of the Parameter Tolerance Problem for Linear Time Invariant Networks," by G. L. Kelly and V. K. Manaktala, University of Kansas

11:30 "Sensitivity Matrices for Multiparameter Networks," by R. Saeks and M. K. Sain, University of Notre Dame

11:45 "A Sensitivity Analysis of Networks Containing Transmission Lines," by C. W. Ho, IBM

9:00 AM CLASSICAL CIRCUIT THEORY (Room of the Dons)

9:00 "The Hybrid Method of Network Analysis," by F. H. Branin, Jr. and L. E. Kugel, IBM

9:30 "Scattering Matrix Synthesis via Reactance Extraction," by S. Vongpanitlerd and B. D. O. Anderson, University of Newcastle, Australia

9:45 "Synthesis of Symmetrical RC and RL Lattice Networks With Maximum Gain and Minimum Number of Elements," by James L. Lowry, Auburn University

10:00 "Sensitivity of Active Two-Ports," by Kotaro Hirano, Kobe University: M. Hashimoto, Kobe University and Ikudo Unami, Fujitsu Co., Ltd., Japan

10:45 "A Quantitative Measure of the Passivity and Activity of Networks," by M. R. Wholers, Grumman Aircraft

11:15 "Capacitance and Resistance Minimization in One-Port RC Networks," J. D. Hagopian and I. T. Frisch, University of California, Berkeley

11:30 "On the Factorization of Transfer Matrices of Lossless Two-Ports," by Alfred Fettweis, Ruhr-University in Bochum, Germany

11:45 "A Passive Synthesis for Time-Invariant Transfer Functions," by P. Dewilde, Stanford Electronics Labs; L. Silverman, University of Southern California and R. Newcomb, Stanford Electronics Labs.

9:00 AM ACTIVE NETWORK SYNTHESIS II (Golden Empire Room)

9:00 "Admittance Matrix Synthesis with RC Common-Ground Networks and Grounded Finite-Gain Voltage Amplifiers," by Reed K. Even, Institute of Technology, Haifa, Israel

9:30 "Optimum Design of Networks Which Use Operational Amplifiers," by G. H. Tomlinson, University of Salford, England

9:45 "Multiport Feedback and Pole-Zero Control," by John R. D'Alessandro, IBM

10:00 "Synthesis of Low-Pass Linear Phase Active Circuits

1969 CIRCUIT THEORY SYMPOSIUM PROGRAM

Using RC Distributed Networks," by Hooshang Mahdi, Northeastern University

10:45 "Driving Point Function Synthesis Using a Unity Gain Amplifier," by Suhash C. Dutta Roy, Indian Institute of Technology, Delhi, India

11:15 "A New Approach to Active Network Synthesis," by A. Sedra and K. C. Smith, University of Toronto, Canada

11:30 "Active Filter Design Using Exponentially Tapered RC-Lines," by J. Walsh, J. C. Giguere, Sir George Williams University and M. N. S. Swamy, University of Calgary, Canada

11:45 "Sensitivity-Compensated Active Networks," by K. E. Daggett, Westinghouse and J. Vlach, Prague, Czechoslovakia

2:00 PM IS CIRCUIT THEORY RELEVANT? (Peacock Court)
PANELISTS:
James H. Mulligan, Jr., National Academy of Engineering (Moderator)
Norman Balabanian, Instituto Politecnico Nacional, Mexico
Norman R. Scott, University of Michigan, Dearborn Campus
Anthony J. Pennington, Drexel Institute of Technology
James A. Resh, Michigan State University
Herbert J. Carlin, Cornell University

GENERAL INFORMATION

Persons intending to attend the Symposium are requested to register for the Symposium in advance by writing to: PROFESSOR P. VARAIYA, DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCES, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA 94720. Late registration will be handled at the Symposium site on Sunday, December 7, 1969 from 4:00 PM to 6:00 PM, and later during the Symposium.

The registration fees for attending the Symposium are as follows: $25.00 for IEEE members; $30.00 for non-members of IEEE; and $3.00 for full-time students.

A social hour is scheduled for Monday evening (December 8, 1969) from 5:30 PM to 7:00 PM in the Peacock Court Room. The tickets for the social hour are available at no cost to all registrants, except the student registrants. The fee for the social hour for all other persons is $3.00 per person.

The social hour is sponsored in part by the following book publishers and time-sharing computer services: Academic Press, Inc., New York, N.Y.; Holt-Rinehart & Winston, Inc., New York, N.Y.; McGraw-Hill Book Company, Inc., New York, N.Y.; Prentice-Hall, Inc., Englewood Cliffs, N.J.; General Electric Information Systems, Schenectady, N.Y.; Tymeshare Inc., Los Altos, Calif. and Remote Computing Corporation, Palo Alto, Calif.

The industrial sponsors of the social hour listed above will be providing exhibits in the Baldwin Room. Exhibit hours are 9:00 AM to 5:30 PM daily during the Symposium.

Please make reservations directly with the Hotel Mark Hopkins, Number One Nob Hill, San Francisco, California 94106. Rooms have been reserved for Symposium attendees at a special rate of $20.00 per day, single occupancy and $24.00 per day, double occupancy, in either double room or twin-bed room. To insure the availability of rooms, please make reservations before November 8, 1969.

Computer Control for Economic Development

At the November 18 AC meeting, Dr. Otto J. M. Smith will present a computer simulation of a non-mechanized agricultural community which has provision for studying the effect of different types of foreign aid. He will make a comparison between the efficiencies of education, trade, food, and medical aid. A threshold level above which the economy can rise to a self-sustaining higher standard of living will be clearly observed. Aid below the threshold level is essentially wasted. The simulation includes distribution of production between trade for capital goods, medical and educational expenses, rent, taxes, food, savings, and social activities. The efficiency of production is a function of health, education, tools, and the population distribution. This multi-loop feedback system shows a biannual resonance.

To synchronize the program to a specific community, a run over the past one hundred years generates a dynamic error vector which is minimized by adjusting some critical parameters. The necessity of using a feedback model to test policy decisions will be illustrated. The features of large multi-loop nonlinear systems and their representations will be discussed.

Dr. Otto J. M. Smith

Dr. Smith has been a professor of electrical engineering and computer sciences at the University of California, Berkeley since 1947. He was a visiting senior research fellow in economics and engineering at Monash University, Melbourne, during 1966-67, where he developed computer programs for simulating the U.S. economy and for power system transient control. At U.C., he was the innovator of a course on economic and biological feedback systems and has been supervising research on simulating ecology, sociological systems, and agricultural economics.

He is the inventor of the low-frequency function generator, of a static magnetic frequency multiplier, of optimal excitation controls for generators, of a variable-speed constant frequency generator, of a carrier-phase-shift computer register, and of adaptive estimators and controllers. He is a Fellow of the IEEE and of the AAAS. He has written numerous articles on optimal control, testing methods, signal generation, and adaptive estimation and control.

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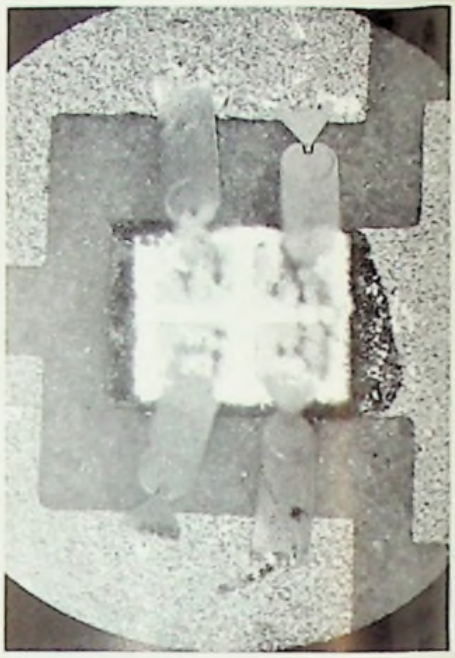
Joint Presentation on Slot Line

Principles and applications of slot-line, particularly for microwave integrated circuits, will be discussed by Dr. Seymour Cohn and Mr. Keith Hunton at the November 12 meeting of the Microwave Theory and Techniques Chapter. Slot-line is a newly studied transmission line structure with special suitability to integrated circuit problems. Dr. Cohn will discuss the basic principles of slot-line and some applications. Mr. Hunton's presentation will complement that of Dr. Cohn by describing a recently-developed broadband balanced mixer in slot-line.



Four Diode Ring at slot-line/coplanar-line junction.

Dr. Cohn is well-known to the microwave community as an outstanding authority on microwave circuits and components. He is self-employed as a consultant to a number of firms across the country. Formerly, Dr. Cohn was Vice President and Technical Director of Rantec and was also Manager of the Electromagnetic Techniques Laboratory at Stanford Research Institute. He is a Fellow of the IEEE and an active member and past chairman of the MTT Administrative Committee.

Dr. Seymour Cohn

Mr. Keith Hunton

Mr. Hunton has authored a number of significant papers on microwave components, principally involving solid-state devices. Holding degrees from the University of Toronto and MIT, he has been employed by Hewlett-Packard as a Section Manager and is currently employed by the Microwave Department of Sylvania Electronic Systems.

The 8:00 PM meeting will be preceded by dinner. See Calendar.

Integrated Circuits for Digital Data Transmission

Two monolithic integrated circuits, a line driver and a line receiver will be described by Robert J. Widlar at the November 17 meeting of the EMC Chapter. These are interface circuits, for standard DTL or TTL, designed to transmit data on twisted pair lines. The combination is unique in that it is powered solely by the 5V logic supplies but can reject noise voltages as high as plus or minus 15V. He will also cover some of the problems encountered in transmitting digital data in a noisy environment.

Robert J. Widlar

Robert Widlar is the Director of Advanced Circuit Development at National Semiconductor in Santa Clara. He received the B.S. degree in electrical engineering from the University of Colorado in 1962. From 1963 to 1966 he was employed by Fairchild Semiconductor, Mountain View, where he headed the development of its linear-integrated-circuit line. He joined National Semiconductor in 1966 where he has designed their line of voltage regulators and advanced operational amplifiers. Widlar has authored more than 40 technical papers on integrated circuits and holds a number of patents on the design of monolithic components.

LSI Technology . . . A Prejudiced View

LSI Technology will be the subject of a meeting of the Electron Devices Chapter on Thursday, November 20. The speaker will be Dr. Andrew S. Grove, Director of Operations, Intel Corporation, Mountain View.

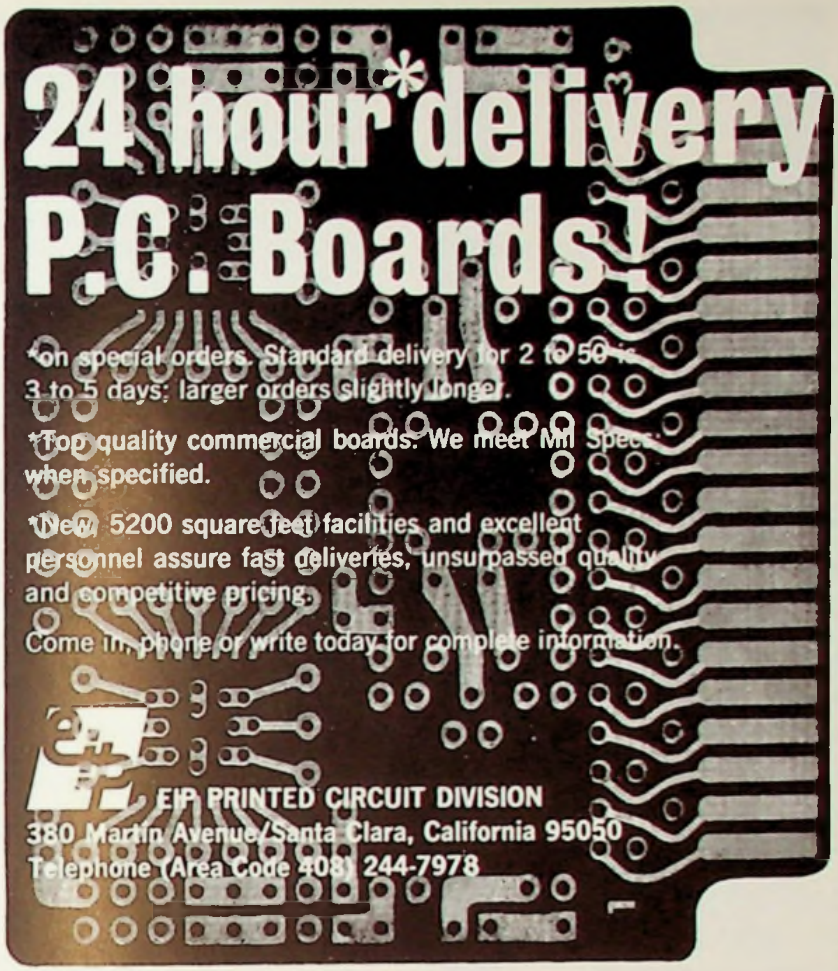
Dr. Grove's talk will consider some recent technological developments of particular relevance to large-scale integration. These include new approaches to increase the functional density of bipolar digital integrated circuits, such as the collector-diffused isolation technique and the use of Schottky diodes, as well as recent trends in MOS LSI technology. Questions such as the relative roles of MOS and bipolar technologies and the interaction of novel chip technologies with packaging techniques will be discussed. Many of these issues are currently under debate and will be settled only by the market place; this talk will provide one set of views on them.

Dr. Andrew S. Grove

Dr. Grove received the B.S. degree from the City University of New York in 1960 and the Ph.D. degree from the University of California, Berkeley, in 1963. In 1963 he joined the Physics Department at the Research and Development Laboratory, Fairchild Semiconductor, Palo Alto, and in 1966 became Head of the Surface and Device Physics Section. In 1967 he was appointed Assistant Director of Research and Development at Fairchild Semiconductor. In July 1968 he participated in the founding of Intel Corporation in Mountain View.

Dr. Grove serves on the Administrative Committee of the IEEE Electron Devices Group and has served on the Electronic Materials Committee of the American Institute of Metallurgical Engineers. He is the author of over thirty technical papers and a book entitled PHYSICS AND TECHNOLOGY OF SEMICONDUCTOR DEVICES, Wiley, 1967.

He is the recipient of the IEEE Region Six 1969 Achievement Award for his contributions to the MOS device field.



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The solid-state "no-break" power system has proven the most reliable and satisfactory answer to solving this application problem. Moon Yuen and David C. Griffith, speakers for the November 26 Golden Gate Subsection meeting, have been intimately involved in the development and applications of these systems since their inception, Mr. Yuen with the many applications installed by

Moon Yuen

Bechtel and Mr. Griffith in the system developments. Together they have presented papers and given talks throughout the country. The meeting will give a review of developments and installations to date and will offer a review of the latest state of the art.

Dinner will precede the 8:00 PM meeting. See Calendar for details.

Dr. Krassowski to Speak at EM Meeting

The Engineering Management Chapter is pleased to announce an outstanding program planned for its Wednesday, November 12 meeting. Dr. Witold Krassowski of the University of Santa Clara will speak on the broad subject of Communications. Since Communications is not only a major problem in business but in all forms of social interaction, the Administrative Committee has declared this program Wives' Night. Accordingly, wives or guests are cordially invited to attend this meeting and a dinner preceding it.

Dr. Krassowski is Director of Social Sciences and Professor of Sociology at the University of Santa Clara. He has received many national and international awards for his work and is advisor/lecturer and/or consultant to many State, U.S. Government and industrial agencies and firms. His broad knowledge in the Communications field and his excellent delivery make him not only an educational but an entertaining speaker as well.

Both dinner and meeting will be held at the Kozy Grotto in Mountain View. Dinner starts at 6:00 PM. The meeting is scheduled for 8:00 PM.

"4 Presidents" Draw 500

The kick-off meeting that launched the 1969-70 season for the San Francisco Chapter of the IEEE Group on Electron Devices overwhelmingly succeeded in getting a massive turnout. Over 500 people heard four presidents in the semiconductor industry "tell it like it is" at the Bold Knight in Sunnyvale, Monday, September 22, 1969.

The guest list included representatives of almost every electronics company on the Peninsula. Conversations during the pre-dinner cocktail hour filled the air with talk about the latest technologies, state-of-the-art, market trends, and an amazing amount of inside information on competitors' products and know-how.

The four presidents on the panel – Lester Hogan (Fairchild), Bob Noyce (Intel), Jim Riley (Signetics), and Charlie Sporck (National) – represented some of the greatest talent in the industry. The most refreshing part of the panel discussion was the friendly rivalry that emerged regularly among the four men.

The panel members' opinions reflected exactly the positions their companies presently maintain in the highly competitive electronics industry. Mr. Hogan feels the future lies in attaining technological leadership, at any cost, and continuing a well-diversified product line in both discretes and IC's. (Not surprising, since Fairchild is an "oldie" in the business with twelve years of experience and one of the largest, most talented professional staffs in the U.S.) Messrs. Noyce and Sporck, both spinouts from Fairchild, and Riley are concentrating on IC's. They feel that a small company should not spread itself too thin, but rather find a specific segment of the market and go in that direction.

Bill Segallis, Western editor of ELECTRONIC PRODUCTS, was moderator. He chose not to depart from the prepared list of questions which had been given to the presidents well ahead of the meeting, thus limiting the opportunity for off-the-cuff, spontaneous answers.

Electronic Parts, Long Distance Space Missions Discussed

Electronic parts and long distance space missions will be discussed by Warren G. Lockyear of JPL at the November meeting of the Reliability Chapter. As Manager of Electronics Parts Engineering for JPL, Mr. Lockyear will describe the planning and technical studies that are now going on to support flights of several years' duration such as the Grand Tour.

The selection of components that meet the reliability goals necessary for 9 to 12-year trajectories poses real problems in technology, economics, and administration. It's hard enough to identify the problems; it's even harder to find the solution. The speaker has been engaged in missile and spacecraft engineering at JPL since 1955. His experience and his reputation as a speaker promise a valuable evening.

The meeting will be held Thursday, November 13, at 8:00 PM in room PH 1004, Stanford. The regular "Meet the Speaker" dinner will be at the Stanford View Restaurant on El Camino Real in Palo Alto at 6:00 PM. Reservations for the dinner are suggested. Call G. Bowers (9962-4111) or Lew Finch (743-1577).

Call for Fellow Grade Nominations

Nomination time for 1971 Fellows is upon us, and sponsors for worthy candidates are needed. Individual members may propose candidates, as well as Group Chapter and Subsection organizations. A new "IEEE Handbook – Fellow Nominations" is available, along with nomination kits, at Section Headquarters. Vic Siegfried (742-6996) is Chairman of the Section Fellow Committee and advises that one-page resumes of possible nominees and a suggested sponsor will start the ball rolling. A deadline of February 2, 1970, is being set for preliminary proposals, after which a screening committee will finalize those selected for Section support.

The general criterion for Fellow nomination is "outstanding and extraordinary qualifications and experience in the fields of electrical engineering, electronics, radio, allied branches of engineering or the related arts and sciences" for members in any grade of IEEE for seven or more years, with "unusual professional distinction." All members of IEEE are urged to take the initiative by looking through their organizations for possible nominees and advising the Section Fellow Committee as early as possible.

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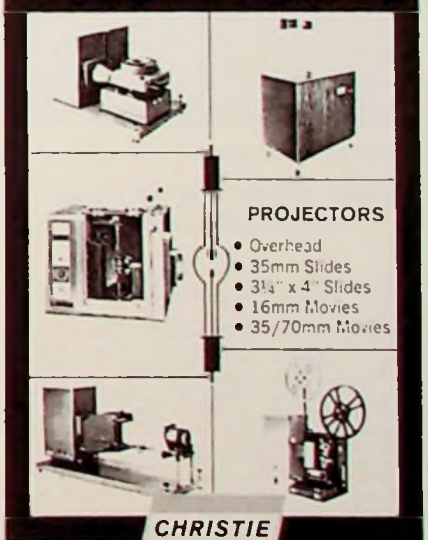

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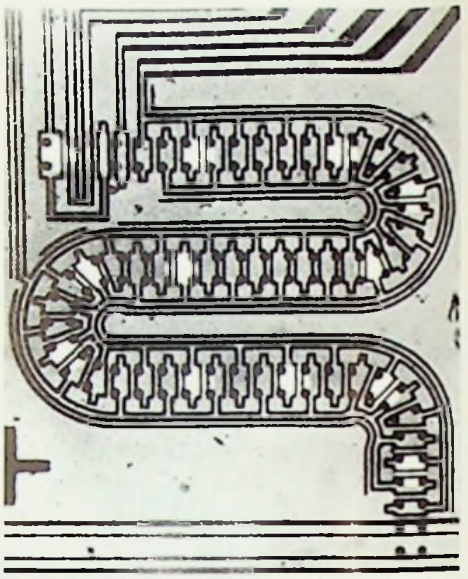
Bubble Domain Devices: A New Approach to Memory and Logic

Recent experiments at Bell Laboratories have shown the potential usefulness for data storage and logic of cylindrical domains – "bubbles" – in orthoferrite platelets. In these devices the stable bubble domains with diameters as small as 0.8 mil can be moved in two-dimensions by sequences of current pulses applied to conductor arrays deposited on the orthoferrite platelets or by a rotating in-plane field acting on permalloy patterns to generate traveling positive and negative poles. These poles can attract or repel cylindrical domains and thereby control their motion. Read-out of the bits, for example in a shift register configuration, can be performed by moving the bubbles into a readout drive loop where they are collapsed and the resulting flux change detected, or by addressing the normally magnetized domains magneto-optically. The domains can be propagated at data rates in excess of 3 megabits/sec. The density of bits has exceeded 10^6 bits/in^2.



This circuit, a photolithographic pattern on the surface of a sheet of thulium orthoferrite, can move magnetic "bubbles" (large white dots) through a shift register at 3 MHz. The magnetic bubbles are 4 thousandths of an inch in diameter.

Mr. Andrew H. Bobeck, who has been instrumental in the development of the bubble domain devices will speak to the Magnetics Chapter on this subject on November 17 at the IBM plant site at Monterey and Cottle Roads in San Jose. Mr. Bobeck received the BSEE and MSEE from Purdue University, and since 1949 has been engaged in solid-state memory and logic development at Bell Telephone Laboratories.

Stabilization and Linearization with Complementary Active Feedback

As the communication technology advanced, the use of wideband signal multiplexing became widespread and the requirements for amplifiers with a high degree of linearity became more acute than ever before. Negative feedback can improve the linearity and stability of amplifiers as the product of gain and feedback factor is increased with a corresponding reduction in the overall gain.

George C. Sziklai

A new method of negative feedback, using the same nonlinearity in the feedback path as the basic nonlinearity in the forward path provides a substantial improvement in the overall linearity compared to a conventional feedback amplifier. An analysis of this feedback scheme and some experimental results illustrating the improvement obtainable will be presented at the Circuit Theory Chapter meeting on November 19 by IEEE Fellow George C. Sziklai.

Mr. Sziklai was employed by the Radio Corporation of America for two decades. From 1956 to 1967 he was Assistant to the Vice President, Research and Engineering and Director of Research, Communication and Electronics for the Westinghouse Electric Corporation. Since 1967 he is a Senior Consulting Scientist of the Lockheed Missile and Space Company in Palo Alto where he conducts general and applied research on information and signal processing, communication and display systems and circuit analysis and synthesis.

A Page From The History of Surveillance

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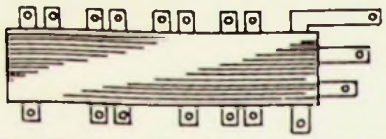

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ESI: What It Is — Where It Is Going

Wednesday, November 19, the SCVSS will have as its speaker Dr. J. Y. Wang, Director of the Environmental Sciences Institute (ESI). Under Dr. Wang's leadership, the Environmental Sciences Institute was established on September 1, 1968. During the past year, the Institute has gained a total of 350 members of both professional and organizational grades, including national and local governmental agencies, various industries, and many universities and colleges. ESI is an official part of San Jose State College.

Dr. J. Y. Wang

Among the 69 projects of the Institute, the priorities for 1969-70 are as follows: Environmental Education System, Surveillance System for Physical and Biological Environment, Design of New City System Model, Determination of Environmental Factors on Vehicular Safety, Detection of Blood Temperature by Means of UHF Waves, and Appraisal of Site Selection for Alaskan Capital. At this time, the Institute is in the process of setting up a WESTERN CENTER FOR ENVIRONMENTAL EDUCATION. When materialized, this Center will offer advanced degrees in the environmental sciences, including engineering degrees.

Dr. Wang is an internationally recognized leader in applied meteorology and is an expert in instrumentation. He is the author of several books as well as over 100 scientific articles. He earned his Bachelor's Degree in physics at the Fukien Christian University (1938) and his Doctorate of Philosophy in Meteorology at the University of Wisconsin (1958). He has been employed as the Dean of Academic Affairs, professor, and research associate at the Fukien Christian University, the University of Wisconsin, the University of Chicago, and San Jose State College. As a staff member of the National Academy of Science and lecturer of the Natural Science Foundation, he was also a Visiting Professor at the University of Oregon.

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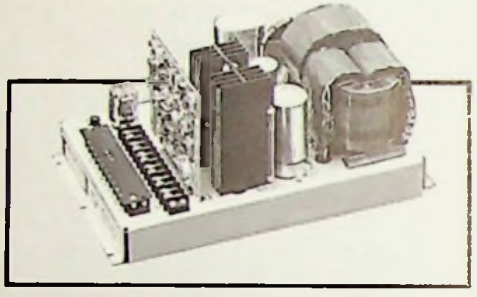

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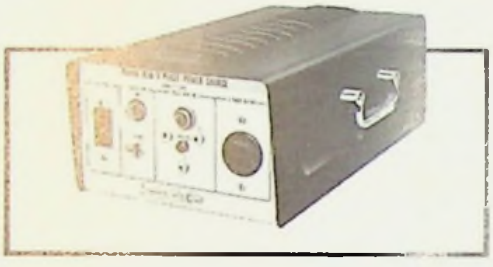

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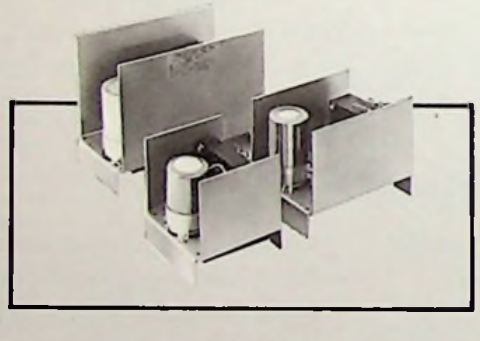

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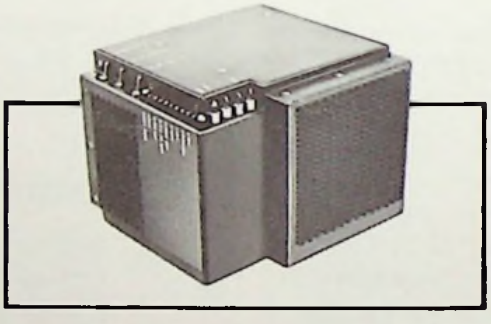

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