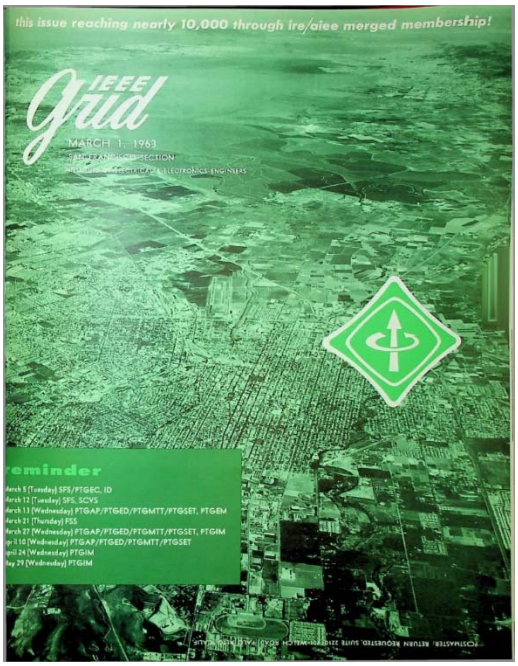
EDITOR'S PROFILE of this issue

from a historical perspective …

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

March, 1963:

Cover: Here we get an early view of what will become Silicon Valley – looking across San Jose with San Francisco in upper-left, Berkeley and Oakland in upper-right. This is a part of the new IEEE's San Francisco Section, part of the new Region 6. As part of the merger of AIEE and IRE, there are several new subsections formed -- Santa Clara Valley, and Fresno -- to supplement the existing East Bay subsection. There are still five Divisions and 20 Professional Groups that need to be re-aligned into the IEEE's new local chapters. Other merger details on page 5.



Archive of available SF Bay Area GRID Magazines is at this location:
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At time of scanning, the bound volumes are held by Paul Wesling. July, 2021 Contact p.wesling@ieee.org

this issue reaching nearly 10,000 through ire/aiee merged membership!

IEEE Grid

MARCH 1, 1963
SAN FRANCISCO SECTION
INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS

reminder

March 5 (Tuesday) SFS/PTGEC, ID
March 12 (Tuesday) SFS, SCVS
March 13 (Wednesday) PTGAP/PTGED/PTGMTT/PTGSET, PTGEM
March 21 (Thursday) FSS
March 27 (Wednesday) PTGAP/PTGED/PTGMTT/PTGSET, PTGIM
April 10 (Wednesday) PTGAP/PTGED/PTGMTT/PTGSET
April 24 (Wednesday) PTGIM
May 29 (Wednesday) PTGIM

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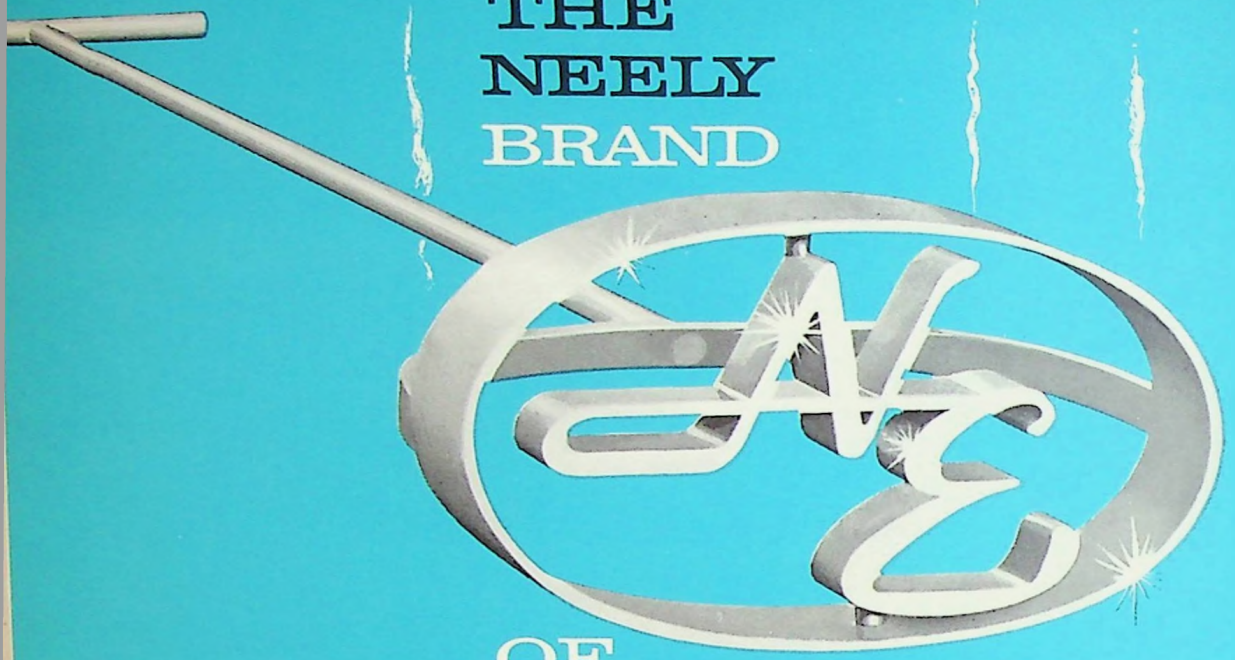

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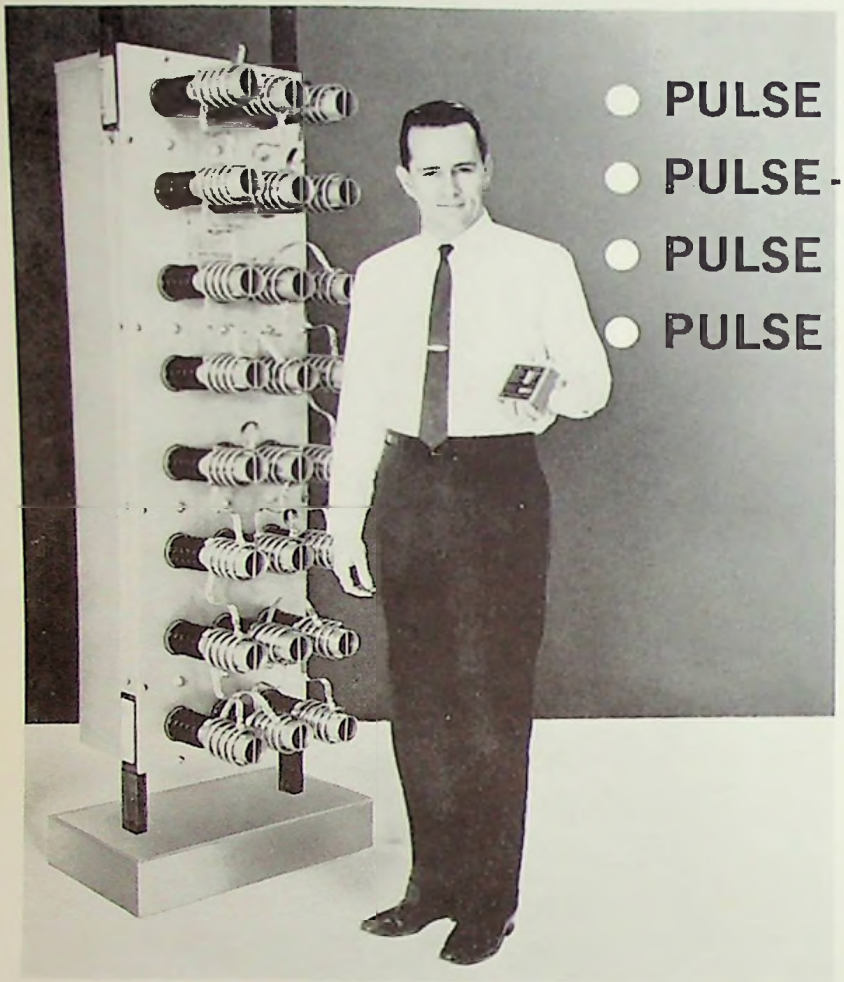

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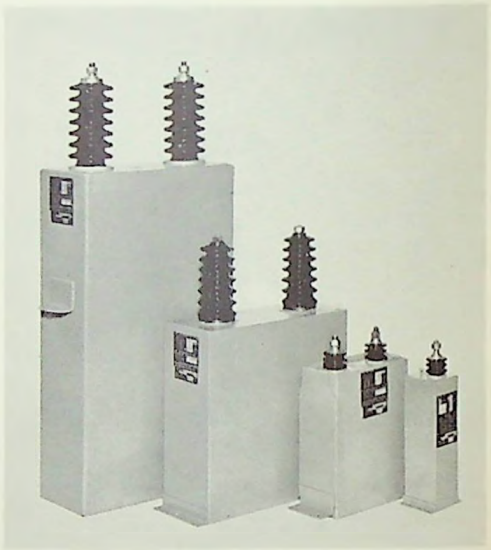

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IEEE Grid

volume 9, number 13

MARCH 1, 1963

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SECTION MEMBERS! To stay on mailing list when you move, send address change promptly to IEEE National Headquarters, Box A, Lenox Hill Station, New York 21, N.Y.

contents

cover

Only a portion of the area to be served by the San Francisco Section of IEEE is shown in this aerial photograph looking from a point above San Jose to the tip of the San Francisco Peninsula, the Golden Gate, and Marin County. Oakland and Berkeley are at upper right.

Proposed section boundaries will include 22 counties: Del Norte, Humboldt, Mendocino, Lake, Sonoma, Napa, Marin, Solano, Contra Costa, San Francisco, Alameda, San Mateo, Santa Clara, Santa Cruz, Monterey, San Benito, Mariposa, Merced, Madera, Fresno, Kings, and Tulare. (Photo courtesy of Air-Photo Co., Palo Alto Airport.)

ieee section chairmen through june 30, 1963

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MEETING CALENDAR

SAN FRANCISCO SECTION
8:00 P.M. • Tuesday, March 5

(Joint meeting with PTGEC)
"Practical Applications for Adaptive Circuits and Systems"
Speaker: Professor Bernard Widrow, Stanford University
Place: Physics Lecture Hall, Room 101, Stanford University
Dinner: 6:00 P.M., The Red Shack, 4085 El Camino Real, Palo Alto
Reservations: May Sharp (Lockheed), DA 3-1831, Ext. 141, by March 4

SAN FRANCISCO SECTION
6:00 P.M. • Tuesday, March 12

Nontechnical, social event along the lines of a stag party
Place: The Village, Columbus at Lombard, San Francisco
Tickets: $6.00 each (including dinner, group entertainment, dominoes, door prizes, and other forms of small group entertainment), from Douglas D. Dodds, EX 2-5353

FRESNO SUBSECTION
8:00 P.M. • Thursday, March 21

"Astron Reactor Design"
Speaker: Dean O. Kippenhan, project engineer, electronics engineering dept., Lawrence Radiation Laboratory, Livermore
Place: P.G. & E. Bldg., 1401 Fulton St., Fresno

SANTA CLARA VALLEY SUBSECTION
7:30 P.M. • Tuesday, March 12

Field Trip
Place: Main Entrance, Jennings Radio Manufacturing Corp., subsidiary of I.T. & T., 970 McLaughlin Ave., San Jose (McLaughlin Avenue is southern extension of S. 24th Street, between Williams and Story roads, near Bayshore Freeway)

DIVISIONS

Industrial
8:00 P.M. • Tuesday, March 5

"A New Approach to 100% Failure-Free Power Systems"
Speaker: Carl E. Gieb, Jr., special project engineer, Ideal Electric & Mfg. Co., Mansfield, Ohio
Place: Room 232, Pacific Gas & Electric Bldg., 245 Market St., San Francisco

PROFESSIONAL TECHNICAL GROUPS

Antennas & Propagation
8:00 P.M. • Wednesday, March 13

(Four-part Tutorial Lecture Series: "Laser Theory, Technique, and Application" —Joint with PTGED, PTGMTT, and PTGSET)
Lecture No. 2: "Gas Discharge and Semiconductor Lasers"
Speaker: Dr. Arnold Bloom, Spectra-Physics Inc., Mountain View
Place: Physics Lecture Hall, Stanford University
Meet-the-Speaker Dinner: 6:00 P.M., Red Cottage, 1706 El Camino Real, Menlo Park
Reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

Antennas & Propagation
8:00 P.M. • Wednesday, March 27

Lecture No. 3: "Laser Techniques and Applications"
Speaker: Professor Anthony Siegman, Stanford University
Place: Physics Lecture Hall, Stanford University
Dinner reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

MEETING CALENDAR

Antennas & Propagation — 8:00 P.M. • Wednesday, April 10
Lecture No. 4: "Laser Developments Overseas—Report on Third International Quantum-Electronic Conference, Paris, 1963"
Speaker: Dr. Malcolm Stitch, Hughes Aircraft Co., Culver City
Place: Physics Lecture Hall, Stanford University
Dinner reservations: Darlene Wheeler, DA 6-6200, Ext. 2695

Automatic Control — 8:15 P.M. • Thursday, March 14
"The Computer Control Problem"
Speaker: Dr. Jack Bertram, manager, controls systems research, IBM
Place: Electrical Engineering 126, Stanford University
Dinner: 6:15 P.M., Old Plantation (formerly Sabella's), El Camino Real & Cherry Chase, Sunnyvale
Reservations: Mrs. Pauline Eckman, DA 1-3300, Ext. 268, by noon, Wednesday, March 13

Electron Devices — 8:00 P.M. • Wednesday, Mar. 13, 27
(Tutorial Lecture Series: Joint with PTGAP, PTGMTT, and PTGSET, see above)

Electronic Computers — 8:00 P.M. • Tuesday, March 5
(Joint meeting with SFS, see above)

Engineering Management — 8:00 P.M. • Wednesday, March 13
Speaker: Dr. Walter H. Schwidetsky, manager, space navigation and data systems, General Dynamics/Astronautics
Place: Caravan Inn, 4375 El Camino Real, Mountain View
Happy Hour: 6.00 P.M.
Dinner: 7:00 P.M., smorgasbord, $3.50 inclusive

Instrumentation & Measurement — 8:15 P.M. • Wednesday, March 27
Lecture No. 3: "The Instrumentation and Performance of the Mariner II Experiments"
Speaker: Ivan Walenta, Mariner II science project engineer, JPL, California Institute of Technology, Pasadena
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto
Dinner: 6:15 P.M., L'Omelette Restaurant, 4170 El Camino Real, Palo Alto
Reservations: Mrs. Marje Andrews, DA 1-3300, Ext. 273

Instrumentation & Measurement — 8:15 P.M. • Wednesday, April 24
Lecture No. 4: "Detection of Planetary Life"
Speaker, place to be announced

Instrumentation & Measurement — 8:15 P.M. • Wednesday, May 29
Lecture No. 5: "Instrumentation for Man in Space"
Speaker, place to be announced

Microwave Theory & Techniques — 8:00 P.M. • Wednesday, Mar. 13, 27
(Tutorial Lecture Series: Joint with PTGAP, PTGED, and PTGSET, see above)

Space Electronics & Telemetry — 8:00 P.M. • Wednesday, Mar. 13, 27
(Tutorial Lecture Series: Joint with PTGAP, PTGED, PTGMTT, see above)

consolidation notes

COUNTERPARTS OF IEEE

With this issue the **Grid** now reaches a merged readership of nearly 10,000 throughout the Bay Area and beyond, including nearly 2000 members of the San Francisco Section of AIEE/IEEE, subscribers, and others.

Merger details, under the co-chairmanship of Stanley F. Kaisel and Robert E. Grady, with Dean Robert Parden of Santa Clara University acting as honorary chairman, have made great progress in considerations of finance, publications, program, membership and related activities, publicity and public relations, and historical committees, all of these areas being virtually agreed upon.

Still to be resolved are awards procedure and organization for the new IEEE section; the formation of a nominating committee and its development of a slate of officers to be elected by the membership for the fiscal/program year 1963-64; the writing and adoption of new bylaws; and the question of how many subsections there will be in the section.

Further progress is expected at the March 5 meeting of the joint merger committee.

Five active AIEE/IEEE divisions have been added to the roster of **Grid** reporters, and their meetings will be publicized in the meeting calendar and elsewhere in the publication in the same manner of handling professional group (now known as professional technical group) meetings in the past.

Details on some of the various AIEE/IEEE chairmen and their activities follow.

Victor E. Kaste is chairman of the section. His firm is the General Electric Co. and his headquarters are at 235 Montgomery St., San Francisco.

W. H. Peterson is vice chairman, responsible for the scheduling of gen-

(Continued on page 10)

John E. Bertram

meeting ahead

CONTROLLING COMPUTERS

The computer control problem will be the subject of J. E. Bertram, manager, controls systems research, IBM, San Jose, at the March 14 meeting of PTGAC, Electrical Engineering 126, Stanford University.

The speaker will explore the control and data-processing problems involved in applying a digital computer to the control of a typical industrial process.

A graduate of Washington University, St. Louis (BSEE) and Columbia University (MS, Engineering Sc.D.), Dr. Bertram was a member of the applied physics group of the engineering research laboratory of DuPont, and an instructor, associate, and assistant professor at Columbia, having been appointed a research staff member in 1958 at IBM, where he has worked on problems related to the use of digital computers in control applications. Since April 1961 he has been manager of control systems research.

meeting ahead

INDUSTRIAL DIVISION OF IEEE

A new approach to 100 percent failure-free power systems will be the subject of Carl E. Gieb, Jr., special project engineer, Ideal Electric & Mfg. Co., Mansfield, Ohio, before the Industrial Division of IEEE on Tuesday, March 5.

The 8 p.m. meeting will be held in Room 232 of the P.G. & E. Building, 245 Market St., San Francisco.

The requirement of failure-free power systems has become increasingly stringent for critical applications such as instrumentation, control, and computer power supplies. Mr. Gieb will review the various systems available today and describe in detail a new development which features emergency power supply up to 2000 KW with no drop in frequency, no drop in voltage, and no shock to the stand-by prime mover.

meeting ahead

JENNINGS FIELD TRIP

The Santa Clara Valley Subsection of IEEE will sponsor a field trip to Jennings Radio Manufacturing Corp., 970 McLaughlin Avenue, San Jose, at 7:30 p.m. on Tuesday, March 12.

The high-power vacuum electronic components test laboratories at Jennings will hold an open house, with demonstrations of high-voltage and high-power DC, AC, and radio frequencies, along with vibration, shock, and other environmental factors. The Jennings high-voltage vacuum-powered switch laboratory has available up to 200,000 amperes at lower voltage levels, and up to 200,000 volts of 60-cycle power. It also has up to 500,000 volts peak of 60 cycles for high-potential testing, and one million volts for $1\frac{1}{2}$x40 microsecond wave impulse testing.

The high-power radio-frequency laboratory has DC and radio-frequency transmitter capabilities up to 400 kilowatts CW, and a frequency range of 300 kilocycles at over 120,000 volts, up to 600 megacycles. This equipment is used for testing the Jennings radio-frequency vacuum switches, vacuum relays, and vacuum capacitors. It also provides up to 70,000 volts DC for testing vacuum switches used to interrupt higher voltage DC. The environmental test lab provides all the requirements of high-power vibration, shock, and other environmental tests required for reliable military applications. This laboratory also provides precision measurement and calibration for the Jennings vacuum-tube voltmeter which measures up to 200 KV peak of 60 cycles, RF and pulse. Special effect of high-power vibration will also be shown.

Robert W. Sumner, Westinghouse Electric Corp., Sunnyvale, is chairman of the subsection; Marvin W. Sheets, General Electric Co., San Jose, is secretary-treasurer.

communication notes

TELEPHONE REVIEW

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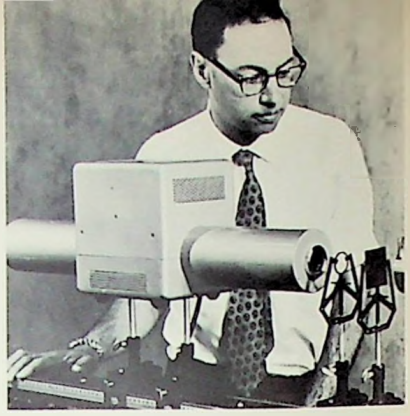


Arnold Bloom

meeting ahead

SECOND IN LASER SERIES

The second lecture in the Laser Tutorial Series is to be given Wednesday, March 13, by Dr. Arnold Bloom, on the subject, "Gas Discharge and Semiconductor Lasers," at the Stanford physics lecture hall.

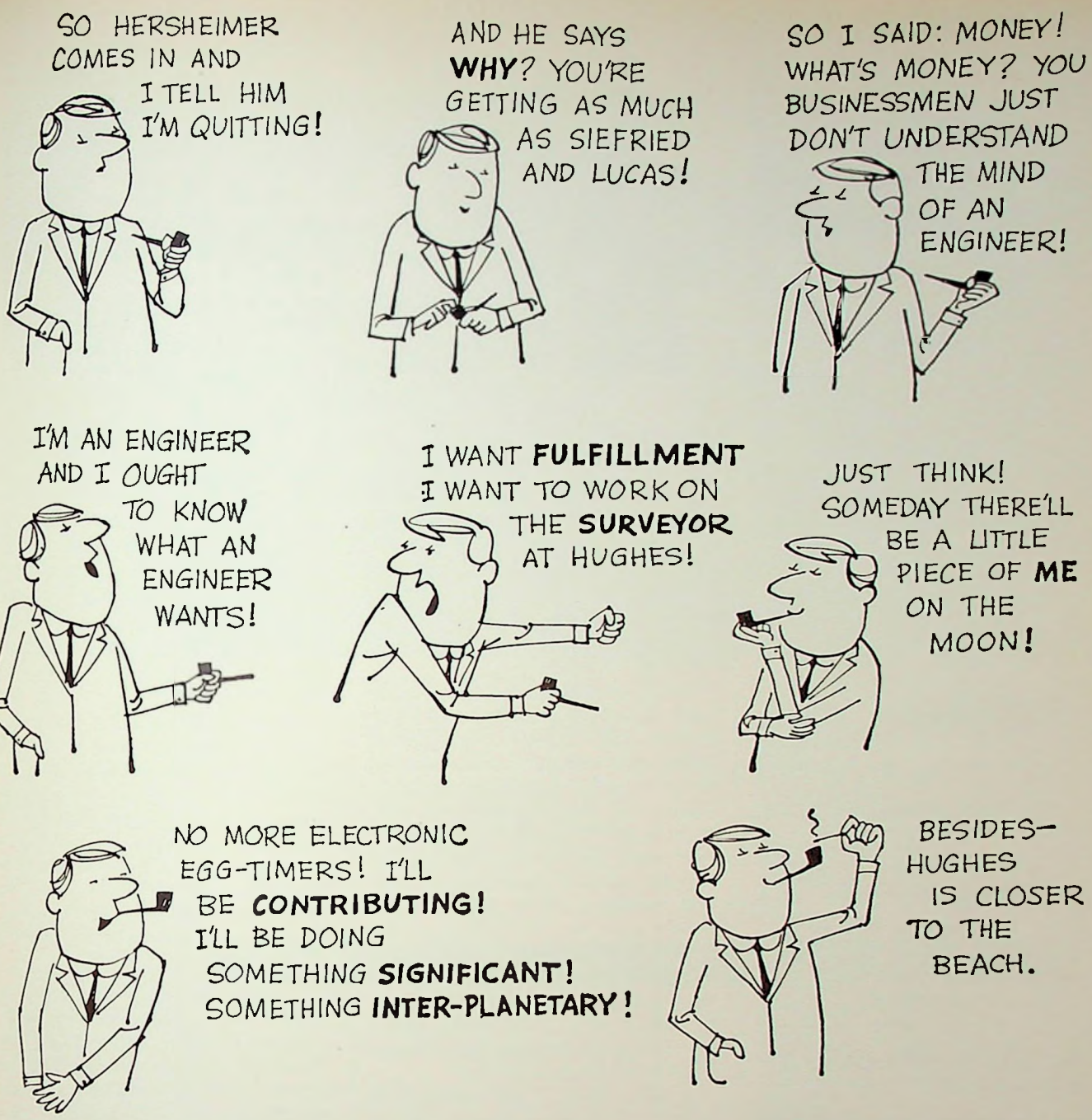
Dr. Bloom performed his doctoral studies in high-energy nuclear physics under Chamberlain and Segrè at the University of California. He has since concentrated on theoretical investigations of resonance physics and optical pumping, accompanied by concurrent experimental work. Beginning at Varian in the theoretical study of nuclear magnetic resonance, he made significant contributions in this field, in 1955 publishing a basic paper on double resonance phenomena. Since then he has published over a dozen papers in the field of optical pumping. During 1958, he studied this subject at the University of Paris with Professor A. Kastler, one of the original discoverers of the optical pumping phenomena. Dr. Bloom has given invited papers at several significant conferences and has authored more than 20 technical papers. He is therefore eminently qualified to discuss those lasers that employ gas discharge excitation.

meeting ahead

FRESNO SUBSECTION

Astron reactor design will be the subject of Dean O. Kippenham, project engineer, electronics engineering department, Lawrence Radiation Laboratory, Livermore, at the March meeting of the Fresno Subsection of IEEE. The 8:00 p.m. meeting will be held on March 21 in the P.G. & E. Building, 1401 Fulton Street, Fresno.

Roy V. Hall is chairman of the subsection; J. M. Swall, P.G. & E., Fresno, is secretary-treasurer.



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David S. Pratt

meeting review

IONOSPHERIC SOUNDINGS

David S. Pratt, project engineer at Granger Associates, presented a very interesting program of slides and motion picture material concerned with synchronized oblique ionospheric soundings, January 15, to a combined meeting of IRE/PGCS/AIEE (Communications Division).

Mr. Pratt described older methods, such as vertical sounding and backscatter, and discussed their advantages and limitations when applied to the 4-to-32-megacycle communications band. The propagation characteristics of this portion of the spectrum were considered in some detail with the aid of slides depicting single and multi-hop paths between two fixed points and the effects of the ionosphere on these paths. These changing characteristics illustrated very well the desirability of changing frequency on a given circuit every few hours if the optimum performance is to be realized.

A description of the synchronized oblique sounding technique and its associated equipment pointed out the advantages of this type of sounding. By transmitting a very-short-duration pulse over an actual or typical communications path, the characteristic of the received pulse (or lack of a received pulse) may be analyzed to determine the usability of the path at a given frequency at a given time. In the synchronized oblique sounding system, a transmitter and receiver are stepped in discrete frequency increments throughout the spectrum of 4 to 32 megacycles.

A pulse of transmitted energy only a few microseconds in duration is transmitted, and its reception or absence at the receiving location is recorded on a suitable storage display tube. As the transmitter and receiver step through the frequency spectrum, a pattern is obtained which will show the lowest usable frequency, the multi-hop characteristics, and the maximum usable frequency at the particular time of sounding.

If soundings are taken at regular intervals throughout the day, actual predictions of changes of the maximum usable frequency may be made prior to the change. The ability to predict these changes has resulted in an increase of the circuit usability from 92 percent to 99 percent over a test path between Hawaii and San Francisco.

The synchronized oblique sounding technique will permit the communications circuit operator to observe when the lowest usable frequency is higher than the maximum usable frequency and, as a result, a circuit rendered inoperative. This condition may easily be observed on present-day sounding equipment.

Mr. Pratt pointed out the importance of known antenna characteristics for both the sounding and the communications circuits. Since the angle of radiation has bearing on the maximum usable frequency, the communication antenna and the sounding antenna, if not one and the same, must have identical characteristics or be capable of being equated.

In the question-and-answer session that followed Mr. Pratt's presentation, it was brought out that interference to other services by synchronized oblique sounding was nil owing to the extremely short pulse duration and slow repetition rate used.

Mr. Pratt joined Granger Associates in 1962. He is participating in design and development of ionosphere sounders and communications systems. From 1957 to 1962 he was a research associate with the electronics laboratory of Stanford University. His duties there included design and development of instrumentation for research in ionospheric physics and radio propagation. He is a member of the IRE and the American Geophysical Union. He is the author or co-author of numerous technical papers and reports.

MAURICE H. KEBBY

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For storage and non-storage displays—The Type 564 has display capabilities for upper-half, lower-half, or full-screen storage or non-storage (with conventional crt operation in the non-storage mode).

The storage capability lends itself to single-shot displays at slow or medium speeds and displays of repetitive waveforms at faster speeds using the integration technique. Single-trace writing speed is faster than 25 centimeters per millisecond. On repetitive traces, the integrate feature provides an increase in stored writing rate. For example, it is possible to increase the stored writing rate by 10 times on 12 repetitive traces.

Storage time can be more than one hour; erase time approximately 250 milliseconds.

The Type 564 has display capabilities for differential, multi-trace, wide-band, delaying sweep, and sampling applications.

Type and degree of performance depend upon 2-Series and 3-Series Amplifier and Time-Base Plug-In Units used.

Type 564 Storage Oscilloscope (without plug-in units) $950

Plug-In Units pictured (in full-screen-storage display):

Type 3A75 50 mv/cm Amplifier Unit $175

Type 2B67 Time Base Unit with single-sweep facility. $175

U.S. Sales Prices, f.o.b. Beaverton, Oregon

Call your Tektronix Field Engineer for more information or to arrange a demonstration.

Wide operating versatility available through 2-series and 3-series plug-ins

AMPLIFIER UNITS TYPE	PASSBAND (3-db down)	SENSITIVITY	PRICE
2A60	dc—1 Mc.	50 mv/cm—50 v/cm 4 decade steps with variable control.	$105
2A63—Differential (50:1 rejection ratio)	dc—300 kc.	1 mv/cm—20 v/cm 1-2-5 sequence, with variable control.	$130
3A72—Dual Trace (Identical Channels)	dc—650 kc. (each channel).	10 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	$250
3A74—Four Trace (Identical Channels)	dc—2 Mc (each channel).	20 mv/cm—10 v/cm, 1-2-5 sequence, with variable control.	$550
3A75	dc—4 Mc.	50 mv/cm—20 v/cm, 1-2-5 sequence, with variable control.	$175
3A1—Dual-Trace (Identical Channels)	dc—10 Mc. (each channel).	10 mv/cm—10 v/cm 1-2-5 sequence with variable control.	$410
3S76—Dual Trace Sampling (for use with 3T77)	equivalent dc-to-875 Mc. (0.4-nsec risetime)	2 mv/cm—200 mv/cm, 1-2-5 sequence, with variable control.	$1100

TIME-BASE UNITS TYPE	SWEEP FEATURES	TRIGGERING	PRICE
2B67	1 μsec/cm to 5 sec/cm, 1-2-5 sequence, variable between rates. 5X Magnifier. Single Sweep.	Internal, External, Line; Amplitude-Level Selection; AC or DC-Coupling; Automatic or Free-Run; ± Slope.	$175
3B1	Normal and Delayed Sweeps—0.5 μsec/cm to 1 sec/cm, 1-2-5 sequence 18 calibrated delay settings, 0.5 μsec to 10 sec, variable between rates uncalibrated.	Internal or External; AC or DC Coupling; Automatic; ± Slope Same features for Normal and Delayed Sweep Modes, except automatic.	$475
3B3	Normal and Delayed Sweeps—0.5 μsec/cm to 1 sec/cm, 1-2-5 sequence. Continuously variable calibrated delay from 0.5 μsec to 10 sec. Single Sweep for main sweep.	Internal or External; Line; AC or DC-Coupling; Automatic; ± Slope; for Normal Sweep Mode; Same features (except no Line or Automatic) for Delayed-Sweep Mode.	$525
3T77 Sampling Sweep (for use with 3S76)	Equivalent to 0.2 nsec/cm to 10 μsec/cm, 1-2-5 sequence, variable between rates. 10X Magnifier.	Internal or External, ± Slope.	$650

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Peterson *Grady*

MORE AIEE/IEEE

eral and technical programs. He is division electric superintendent of the East Bay division, P.G. & E.

Gerard K. Lewis is secretary-treasurer of the section. His firm is the Allis-Chalmers Mfg. Co. with headquarters at 142 Sansome St., San Francisco.

Robert E. Grady is junior past chairman of the section and chairman of the joint merger committee. He is a consulting engineer.

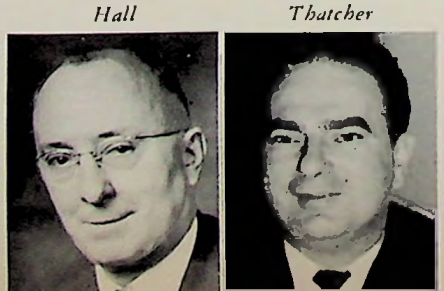
Tilles *Garland*

Dr. A. Tilles is a past chairman of the section and is currently chairman of the transfers committee, responsible for encouraging the upgrading of members and selecting members for the grade of Fellow. He has taught at the University of California and the Israeli Institute of Technology in Haifa. He is presently in the electronics engineering department at the University of California Lawrence Radiation Laboratory at Livermore.

W. D. Garland is a member at large of the executive committee and chairman of the subsection committee. He is a staff transmission engineer with P.T. & T.

Roy V. Hall is chairman of the Fresno subsection and has placed emphasis in programming on reaching high school science classes and college students. He served with P.G. & E. from 1926 until March 1, 1956, retiring at that time.

Hall *Thatcher*



Dols *Howland*

Charles G. Dols is chairman of the technical papers committee which conducts the section prize paper contest. He is an electronics engineer at the University of California's Lawrence Radiation Laboratory.

Robert Howland is vice chairman of the program committee of the Communications Division. He is also treasurer of PTGEWS. As senior engineer with P.T. & T. he is responsible for many of the private line service designs for the military services.

McCann *Wells*

James J. McCann is chairman of the technical program committee of the Power Division. He is supervising electrical engineer, department of engineering services, P.G. & E.

J. A. Wells is chairman of the Industrial Division technical programs. He founded Artwel Electric, manufacturing representative firm, in 1957.

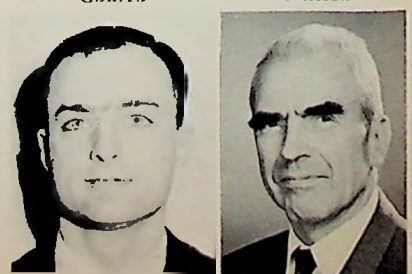
Frank Thatcher is chairman of the publicity committee and responsible for coordinating material for the Grid. He is a transmission engineer with P.T. & T.

Ronald K. Church is program chairman of the Instrumentation and Controls Division. He is a member of the product development and production engineering operations at Hewlett-Packard, Palo Alto.

Einar Nilsson is chairman of the fellowship committee, responsible for welcoming new members at the sec-

(Continued on page 12)

Church *Nilsson*



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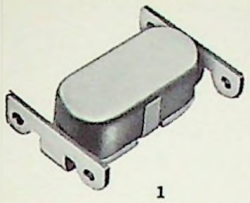
For Electronic, Avionic, Aerospace Applications

(Typical units shown; many other types available)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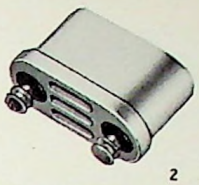
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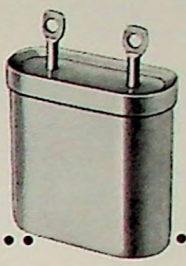
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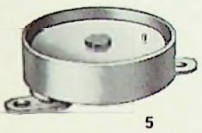
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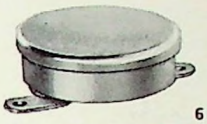
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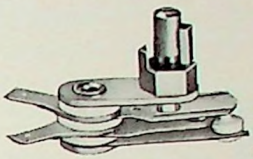
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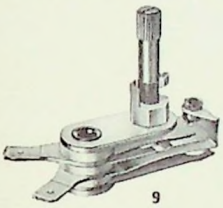
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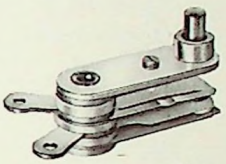
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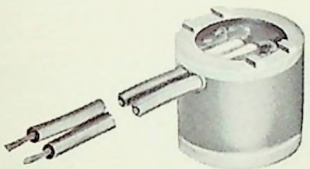
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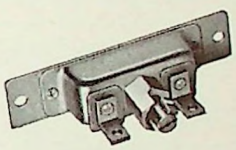
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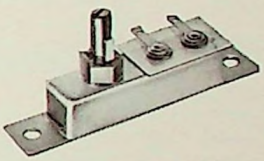
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16

1, 2, TYPE C† semi-enclosed (1), hermetically sealed (2). Small, positive acting with electrically independent bimetal strip for operation from –10° to 300°F. Rated at approximately 3 amps, depending on application. Hermetically sealed type can be furnished as double thermostat "alarm" type. Various terminals and mountings. Bulletin 5000.

3, 4, TYPE M*† semi-enclosed (3), hermetically sealed (4). Snap acting bimetal disc types for electronic applications from —50° to 300°F. Rating: 3 to 10 amps at 115 VAC and 28 VAC/DC. Semi-enclosed with virtually any type terminal; hermetically sealed with pin or solder terminals, wire leads, various mounting brackets. Bulletin 6000.

5, 6, TYPE MX† semi-enclosed (5), hermetically sealed (6). Snap acting miniature units to open on temperature rise for missile, avionic, electronic and similar uses. 2° to 6°F differentials available. Rated at 3 amps to 1 amp, depending on duty cycle, at 115 VAC and 28 VAC/DC. Semi-enclosed types with metal or ceramic bases; hermetically sealed in circular or CR7 cans. Various terminals, mountings, brackets, etc. Bulletin 6100.

7, 8, TYPE S*† adjustable (7), non-adjustable (8). Positive acting with single stud or nozzle mounting. Operation to 600°F. Rated at 15 amps at 115 VAC, 7 amps at 230 VAC. Spade, screw or formed terminals, various adjusting stems, etc. Bulletin 1000.

9, TYPE SA*† adjustable, or non-adjustable. Snap acting with electrically independent bimetal. Also single-pole, double-throw. Single stud or nozzle mounting. Rated at 1650 watts at 115-230 VAC only. Spade or screw terminals. Bulletin 2000.

10, TYPE SM*† manual reset. Electrically same as Type SA except for manual reset feature. Bulletin 2000.

11, 12, TYPE A*† semi-enclosed (11), hermetically sealed (12). Insulated, electrically independent bimetal disc gives fast response and quick, snap action control for electronic and apparatus applications from –50° to 300°F. Lower or higher on special order. Rating: 4 to 15 amps, depending on duty cycle, at 115 VAC and 28 VAC/DC. Various enclosures and mountings, including brackets. Bulletin 3000.

13, POTTED TYPES A* & G*. For refrigeration, air conditioning, or applications requiring a sealed thermostat, the Types A and G are available with lead wires and epoxy sealed. Type G is shown. Various mounting brackets. Bulletin 3000 for Type A, Bulletin 3500 for Type G.

14, TYPE R*† sealed adjustable, sealed non-adjustable. Positive acting for operation to 600°F. Rated at 15 amps at 115 VAC, 4 amps at 230 VAC. Screw terminals. Bulletin 7000.

15, TYPE W*† adjustable, or non-adjustable. Snap action bimetal strip type for operation to 300°F. Depending on duty, rated: 5 to 10 amps, 115 or 230 VAC. Screw or nozzle mountings; spade or screw terminals. Bulletin 4000.

16, TYPE G* exposed, or enclosed bimetal disc types, or epoxy sealed for moisture and dust resistance. Snap action for positive and instantaneous opening or closing of electronic and avionic circuits to 300°F. Various mountings and terminals. Bulletin 3500.

Illustrations, for general information only, do not necessarily show size comparisons. Fully dimensioned and certified prints on request. Manufacturer reserves right to alter specifications without notice.

***Refer to Guide 400 EO for UL or CSA approved ratings.**

†These thermostats covered by patents issued or applied for. A-3702A

STEVENS *manufacturing company, inc.*

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STEMCO®

THERMOSTATS

meeting review

SOLVING CONTROL PROBLEMS

An interesting approach to the solution of optimal control problems was presented at the January 31 meeting of the PGAC. Dr. J. B. Rosen, visiting professor of computer science at Stanford University, developed a convex programming solution employing a somewhat more general cost function than is usually considered.

Given the vector differential equation

$$\dot{x} = f(x,u(t),t);\ 0 \leq t \leq T$$

where x is the n-dimensional state vector and u is the r-dimensional input vector, we are asked to find that input u(t) that minimizes

$$\phi[u] = \rho(x(T))$$

where $\rho(x)$ is a convex function of x. We furthermore constrain both the state and input vectors to lie inside the region

$$\begin{cases} q^-(t) \leq u(t) \leq q^+(t) \\ p^-(t) \leq x(t) \leq p^+(t). \end{cases}$$

Dr. Rosen first rephrased the problem in terms that made it amenable to attack by programming methods. When attention is limited to the case where the equations for $\dot{x}$ are linear but ρ is allowed to be nonlinear, explicit solutions can be found for x as a function of u. In this continuous case, however, the solution for the minimum becomes an infinite-dimensional programming problem.

In order to reduce the dimensionality, a finite-dimensional approximation is made. The interval $0 \leq t \leq T$ is broken into m equal lengths Δt. Using this approximation and taking advantage of an efficient convex programming method, rapid solutions can be obtained on present-day computers such as the IBM 7090.

Slides were presented which showed the results of solutions of problems with $n = 4$ and $n = 8$ using $m = 25$ and $m = 50$. One point that evoked considerable interest was the fact that the solutions are not "bang-bang"; that is, they do not necessarily lie on the control or state vector constraints for all t, because of the type of cost function used.

Dr. Rosen remarked that the program had been run some 25 times

(Continued on page 13)

Dole

Dodds

tion meetings. He is supervising electrical engineer at P.G. & E., his duties including engineering and design of the electrical part of thermal electric power plants and metropolitan substations.

A. R. Dole is chairman of the Communications Division, technical program committee. He is a senior engineer with P.T. & T. in the chief engineer's department, protection group.

Douglas D. Dodds is chairman of the attendance committee, responsible for encouraging attendance, arranging transportation, arranging dinner meetings, and handling tickets at special events. He is district engineer for Westinghouse Electric Corp. and concerned with apparatus applications for industrials.

Morris

Kaisel

E. W. Morris is chairman of the technical conference committee, responsible for recommending conferences of interest to the membership. He is a Fellow, a past national director, a past secretary of District 8, and was chairman of the Los Angeles Section in 1946-47. He is Pacific zone engineer, electric utility department, Westinghouse Electric Corp.

Chairman of the IRE/IEEE joint merger committee is Dr. Stanley F. Kaisel, president of Microwave Electronics Corp. Serving on his committee are Albert J. Morris, president of Radiation at Stanford; Dr. Peter Lacy, section chairman and president of Wiltron Co.; Peter Sherrill, West Associates; and James D. Warnock, section executive secretary.

meeting review

ZERO-SUM GAMES

On January 24, 1963, at the Philco Auditorium, Dr. William L. Root of the University of Michigan addressed a PGIT audience of forty on "Communication Through Unspecified Additive Noise."

In the face of heavy and completely unstructured interference, as contrasted with additive noise of known statistics or the multiplicative noise of multipath, the theory of two-person zero-sum games is pertinent. One player is the communicators; the second player is nature or a jammer, whichever is producing the interference. If the interference is bounded at a level A and the minimum signal level is 1, then A is the maximum noise-to-signal ratio and is assumed to be greater than one.

The payoff for the game is simply the probability of making a correct decision. Since coin tossing at the receiver gives a probability of correct decision of one-half, the communication system must give a payoff larger than one-half to be useful. For simplicity, the theory is derived for a binary system using an off-on signal with energy detection and with equal a priori probabilities for the two signals. The interference actually present is B in the range $0 \leq B \leq A$. Hence B is the strategy parameter for nature.

Let the communicator use a decision rule $d_c(x)$, with c as his strategy parameter. With d_c equal to 1 when the decision is mark (signal) and d_c equal to zero when the decision is space (no signal), the payoff is

$$P(c,B) = \tfrac{1}{2}[d_c(1+B) + 1 - d_c(B)]$$

If nature uses the mixed strategy of distributing B uniformly from 0 to A, the expected value of the payoff is

$$E[P(c,B)] = (1/A)\int_0^A \tfrac{1}{2}[1 + d_c(1+B) - d_c(B)]\,dB$$

which reduces to

$$E[P(c,B)] = \tfrac{1}{2} + (1/2A)$$

where $d_c(x)$ has been taken as 1 for $A \leq x \leq 1 + A$ and equal to 0 for $0 \leq x \leq 1$.

(Continued on page 18)

on problems of various sizes using the "gradient projection" method for convex programming. Solution times were of the order of two or three minutes even for problems of large dimension.

A. S. MC ALLISTER

consolidation notes

PUBLICATIONS POLICY

For the benefit of those who may have missed it, we are reprinting a letter which appeared in the November PROCEEDINGS from Messrs. Patrick E. Haggerty and B. Richard Teare, Jr., many queries on the subject having been received by the Section Office:

To the Members of IRE and AIEE:

Numerous inquiries have been received concerning the publications policy to be followed after the merger of AIEE and IRE. Although this policy was published as Article XIV of the "Proceedings of Consolidation" in the supplement to the April issues of the IRE PROCEEDINGS and ELECTRICAL ENGINEERING, it seems wise to restate it briefly for the benefit of all members.

IEEE will publish for a transition period of one year (the calendar year 1963) ELECTRICAL ENGINEERING and PROCEEDINGS OF THE IRE in substantially their present form, with additional material on IEEE news, abstracts, and other information of interest to the general membership. This transition period may be extended for an additional period of up to one year by the IEEE Board of Directors. During this transition period, members of IRE at the time of merger will receive only the PROCEEDINGS, and members of the AIEE at that time will receive only ELECTRICAL ENGINEERING. Members of both Institutes at the time of merger, and new members of the IEEE, will receive one of these two publications at their choice. Any member may subscribe to the alternative publication.

The policy to be followed subsequent to this transition period will be the subject of intensive study by an Editorial Committee to be appointed by the IEEE Board of Directors immediately following the date of merger. The objective of this study will be to devise policy and procedures to satisfy the needs of the IEEE membership for publications of high technical quality and broad general interest.

The IEEE will publish TRANSACTIONS produced by the Professional Technical Groups (including the pres-

ent IRE Professional Groups and the AIEE Institute Technical Groups) and will also publish periodicals sponsored by the IEEE Technical Operating Committee (the successor to the AIEE Technical Operating Department). IEEE will publish a periodical for student members, containing technical material and news items. Other publications, such as a Directory of Members with lists of manufacturers, products, and supplies, Convention and Conference Records, Cumulative Indexes, Standards, etc., will be published when warranted.

This policy is intended to maintain and strengthen, during the transition period, the present high standard of service rendered by the publications of the two Institutes. All members will be informed promptly in the pages of ELECTRICAL ENGINEERING and the PROCEEDINGS when the IEEE Board of Directors decides on the policy to be followed after the transition period.

PATRICK E. HAGGERTY
B. RICHARD TEARE, JR.

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MORE PGIT

If the communicator's freedom is reduced by requiring him to use a threshold decision rule and integer values for that threshold, then the optimal strategies are a uniform distribution for nature and equal probabilities for the thresholds 1, 2, . . . , [A + 1], the largest integer in A + 1. In this case the expected value of the payoff is

$$E\{P(c,B)\} = \tfrac{1}{2} + (1/[A+1])$$

Dr. Root stated that this minimax approach can probably be extended to detection schemes other than energy detectors. Some of his earlier work on this problem was reported in the March 1961 issue of Information and Control.

After receiving his Bachelor's and Master's degrees in electrical engineering, Dr. Root received his Ph.D. in mathematics from MIT in 1952. He was associated with MIT and Lincoln Laboratory until assuming his present position as professor of instrumentation engineering at the University of Michigan in 1961.

CHARLES H. DAWSON

events of interest

April 17-19—**SWIRECO** (Southwestern IEEE Conference and Elec. Show). Dallas Memorial Auditorium, Dallas, Texas. Exhibits: Hal Copeland, 810 Wilson Bldg., Dallas 1, Texas. Program: Prof. A. E. Salia, E.E. Dept., Arlington State College, Arlington, Texas. No Proceedings.

April 17-19 — **Int'l Special Tech. Conf. on Non-Linear Magnetics.** Shoreham Hotel, Washington, D.C. Program: J. J. Suozzi, BTL Labs., Whippany, N.J. *DL-11-5-62. Proceedings: Order from IEEE Headquarters after Conference.

April 24-26—**6th Region Technical Conference.** San Diego, Calif. Program: George C., Tweed, Jr., 8080 Pasadena Ave., La Mesa, Calif. No Proceedings.

May 2-3—**4th Nat'l Symposium on Human Factors in Elec.** Marriott Twin Bridges Hotel, Washington, D.C.

May 7-9—**Electronic Components Conference.** Marriott Twin Bridges Hotel, Washington, D.C. Program: James Hannon, G.E. Co., 777-14 St., N.W., Washington, D.C. Proceedings: IEEE Headquarters after Conference.

the section

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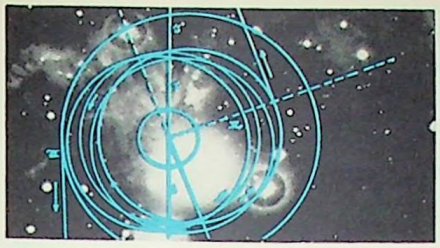

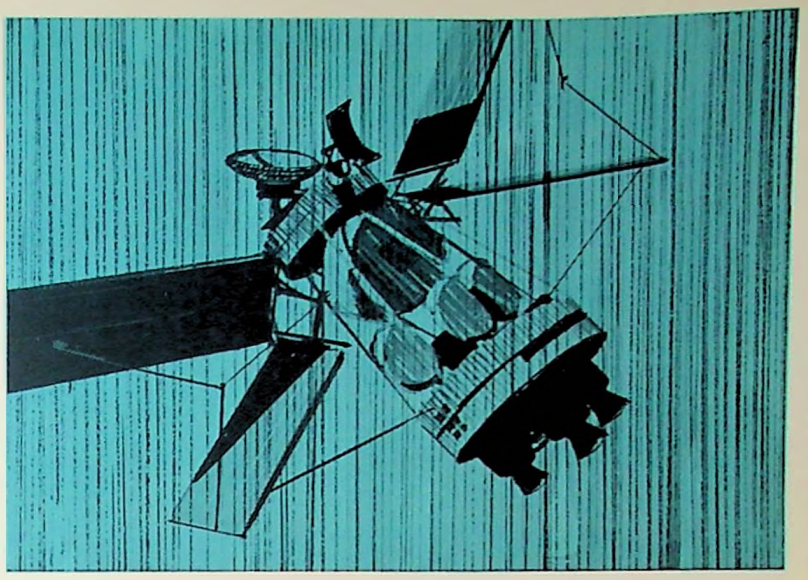

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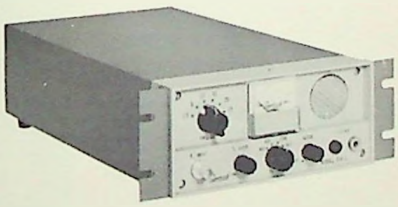

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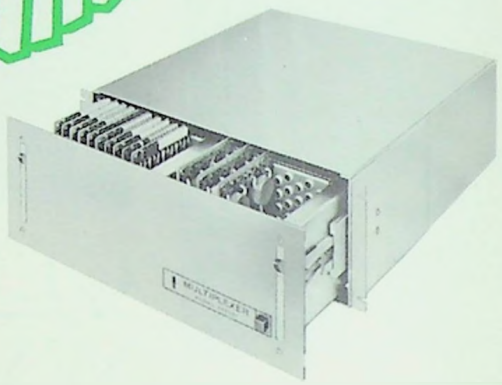

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