Advance Program

Thursday and Friday—February 12 and 13, 1959

Irvine Auditorium and University Museum,
University of Pennsylvania
and the Hotel Sheraton, Philadelphia, Pa.

REGISTRATION: Hotel Sheraton—Wednesday, February 11, 1959—6:00 P.M.-10:00 P.M.
Irvine Auditorium—Thursday, February 12, 1959—8:00 A.M.-9:00 A.M.
Irvine Auditorium—Friday, February 13, 1959—8:00 A.M.-9:00 A.M.
SESSION I: Solid-State Microwave Electronics I  
Irvine Auditorium—9:00 A.M.—12:00 Noon

Chairman: E. D. Reed, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

1.1: Amplification By Nonlinear Reactance: A Survey  

The principles of operation of s-hf variable-reactance diode amplifiers will be reviewed, and methods for utilizing minimum-loss-reactance diodes will be discussed. Systems tests show that diode amplifiers can be very satisfactory in dynamic range, bandwidth and stability; noise figures of about 1 db are obtained.

1.2: Low-Noise 400-Mc Reactance Amplifiers  
P. P. Lombardo, Applied Electronics Department, Airborne Instruments Laboratory, Mineola, N. Y.

This paper describes a balanced version of a 400-mc reactance amplifier which has been designed and tested under several modes of operation. These include the sum-frequency, 2-port and 1-port difference frequency modes. Noise figure, bandwidth, and gain measurements are described. Construction details of the various amplifier configurations are discussed.

1.3: Nonlinear-Reactance (Parametric) Traveling-Wave Amplifiers for UHF  
R. S. Engibrecht, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

The application of (“varactor”) semiconductor diodes in parametric traveling-wave amplification will be described. The capabilities with regard to bandwidth (over 25%), pumpout power (about 10 milliwatts) and noise figures (equivalent input noise temperatures 59° to 100° K) for experimental amplifiers designed for s-hf will be presented.

1.4: Large-Signal Characteristics of Three-Frequency Cavity Parametric Amplifiers  
K. L. Kotzebue, Stanford University, Palo Alto, California

The large-signal saturation characteristics of three-frequency negative-resistance type parametric amplifiers utilizing resonant circuits have been analyzed and yielded values for the saturated power output as an amplifier, and power output as an oscillator as a function of applied pump power. Experimental large-signal data of a three-frequency microwave parametric amplifier are presented showing good agreement between theory and experiment.

1.5: Multiple Frequency Parametric Devices  
Haung Hsu, Electronics Laboratory, General Electric Co., Syracuse, N. Y.

Single stage parametric amplifiers and converters can be designed to perform functions of multi-stage devices. Several examples will be described and analyzed such as a regenerative monostable two stage up-converter having higher gain than a conventional balanced, parametric amplifier for signal frequency higher than pump frequency, and tunable devices with fixed output frequencies.

SESSION II: Memory Techniques  
University Museum—9:00 A.M.—12:00 Noon

Chairman: R. H. Baker, MIT, Lincoln Laboratory, Lexington, Mass.

1.1: Twistor Buffer Store  
K. Preston, Jr., and Q. W. Sinkins, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

This paper reports on the development of a twistor buffer store having a capacity of thirty 22-bit words. The store is completely transistor driven. This paper reports on the development of a twistor buffer store having a capacity of thirty 22-bit words. The store is completely transistor driven. This paper reports on the development of a twistor buffer store having a capacity of thirty 22-bit words. The store is completely transistor driven. This paper reports on the development of a twistor buffer store having a capacity of thirty 22-bit words. The store is completely transistor driven.

1.2: Impulse Switching of Ferrites  
R. E. McMahon, MIT, Lincoln Laboratory, Lexington, Mass.

Impulse switching of ferrites has allowed memory cycle times of less than .5 microsecond to be achieved. The important characteristics of impulse switching as well as the limitations will be described. The future use and applications of this mode of operation will also be discussed.

1.3: Ferrite Apertured Plate Memories  
C. S. Warren, RCA, Camden, N. J.

It will be described how this paper highlights some of the problems associated with the design of ferrite apertured plate memories. A brief description will be given of both coincident current and linear selection memories using ferrite plates. Data will be presented on actual memory systems which have been evaluated, to show what relative advantages can be achieved using ferrite plates.

1.4: Superconducting Memory  
C. J. Kraus, IBM, Kingston, N. Y.

The principles of a trapped flux, superconducting multiple layer film memory will be covered and test results of an operating plane will be discussed. The advantages and disadvantages of this type of memory, based on actual test data, will be presented. In addition, critical problems of superconducting film evaporation control will be discussed.

1.5: Thin Magnetic Film Memories  
E. E. Bittmann, Research Center, Burroughs Corp., Poughkeepsie, N. Y.

Small random access memories, using deposited magnetic films, 200Å thick, 3/16" diameter, where driving and sensing circuits have been transistorized, will be described. Memory cycle time is 1 microsecond, flux switching time ~1 microsecond, and output signal 5 mV. Memory plane wiring configurations, which are not noise sensitive, have been selected.

LUNCH: 12:00 Noon to 1:15 P.M.—University Museum

SESSION III: Applications of New Devices I  
Irvine Auditorium—2:45-5:15 P.M.

Chairman: A. P. Stern, Electronics Laboratory, General Electric Co., Syracuse, N. Y.

3.1: Hall-Effect Devices: A Survey  
W. J. Grubbs, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

This paper will present the results of a survey of about twenty Hall-effect devices, including the gyroscope, isolator, circulator, spectrum analyzer and analog multiplier. Semiconductor materials will be discussed in terms of what is desirable and how currently available materials limit the usefulness of these devices.

3.2: Superconductive Electronic Circuits: A Survey  
D. A. Buck, MIT, Cambridge, Mass.

This survey will discuss the possibilities of exploiting the unusual electrical and magnetic properties of superconductors in configurations which offer attractive power and memory capacity advantages for digital computer applications. New techniques describing how a minute complete printed circuit can be used in the operation will be proposed.

3.3: Proposed New Cryotron Geometry and Circuits  
R. K. Richards, Consulting Engineer, Wappingers Falls, N. Y.

A proposal covering a cryotron geometry, formed with a set of concentric superconductors, which offers potential advantages, notably much higher speed of operation, will be offered. A new set of cryotron logical circuits will be described. Complex logical functions such as those involving “don’t care” conditions can be derived in a more straight-forward manner than with previous circuits.

3.4: An Electro-Optical Shift Register  
T. E. Bray, Electronics Laboratory, General Electric Co., Syracuse, N. Y.

This paper describes an electro-optical shift register composed of electro- luminescent and photoconductive elements only. An analysis of the basic electro-optical regenerative connection will be presented which yields useful design criteria for the shift register. Attributes and limitations of this circuit will be given.

3.5: Miniaturized Ceramic Filters  
S. W. Tehon, Electronics Laboratory, General Electric Co., Syracuse, N. Y.

Highly stable piezoelectric ceramics provide narrow bandwidth filters with small volume, excellent selectivity and low insertion loss. This paper describes a design technique based on the use of image parameters which permits control of impedance, bandwidth and shape factor through one of equivalent electromechanical circuits. The design method is illustrated by a specific implementation transforming filter which is typical and encountered in miniaturizing communication systems.

FORMAL OPENING AND WELCOME: 1:30-2:35 P.M.—Irvine Auditorium

Introductory Comments—J. A. Morton, Chairman of Conference

Welcoming Remarks—G. F. Harndell, President, University of Pennsylvania

Invited Address—M. J. Kelly, President of Bell Telephone Laboratories, Inc.
SESSION IV: Linear Circuits
University Museum—2:45-5:15 P.M.


4.1: A New Approach to the Design of Low Drift DC Amplifiers

This paper describes the application of a new low-level silicon transistor which permits considerable drift reduction, particularly of errors due to the change in 

\[ 0.01 \text{ millivolt per degree} \]

of temperature. The drift voltage of the circuit is of the order of 0.05 millivolts per degree, which is a marked improvement over the drift of conventional transistors of this type. The circuit is capable of handling large input signals and of maintaining stability over a wide range of frequencies.

4.2: Design of a Transistorized 1-Megohm Analog-to-Digital Encoder
C. P. Villare, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

The design of a seven-digit binary network encoder will be discussed. Emphasis will be placed on accurate signal measurement at high speed. Special factors discussed will be (1) Accuracy of references; (2) conversion time; (3) linearity of the feedback loop. These considerations will be illustrated in the design of a practical encoder.

SESSION V: Applications of New Devices II
Irving Auditorium—9:00 A.M.-12:00 Noon

Chairman: P. M. Thompson, Defense Research Telecommunications Establishment, Ottawa, Canada

5.1: Silicon Controlled Rectifier Inverters

This paper will describe the use of 16-ampere silicon-controlled rectifiers in various inverter circuits with emphasis on commutation requirements, firing arrangements, and load limitations. A number of novel solid-state devices for use in power inverter circuits will also be described and typical performance curves for practical inverter circuits are given.

5.2: Applications of PN-N Triode Switches
W. H. Grinch and H. Has, Fairchild Semiconductor Corp., Palo Alto, California

The characteristics and switching applications of a developmental diffusion PN-N PN-be triode will be discussed. The device is capable of handling 80-ampere-650-millisecond pulses with rise and fall times in the order of 100 millisecond cycles, 1000 cycles, and 1000 millisecond cycles, respectively, at 1-kv peak. The switching mechanism, frequency and power limitations, and the characterization of the device parameters will be discussed.

5.3: Some Circuit Applications of the Field Effect Current Limiter
E. L. Doucette, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

The usual nonlinear behavior of the field effect current limiter can be used to perform many diverse and useful functions. Those to be described include: Current regulation, frequency independent ac-dc discrimination, inclusion, and switching, wave shaping and clipping, timing circuits for threshold devices, digital-to-analog encoding and step-function generation.

5.4: Circuit Applications of Stepping Transistors
E. P. Kovanic, Ford Telephone Laboratories, Inc., Murray Hill, N. J.

This paper will describe some circuit configurations of the stepping transistor, the solid state equivalent of a gas-switching tube. The transistor characteristics will be described, as well as circuits yielding outputs for every step of the device. Methods of increasing the output voltage and of providing self-limiting will be presented.

5.5: Integrated Devices Using Direct Coupled Unipolar Transistor Logic

A logic system using directly coupled unipolar transistor elements will be described. By integration of such elements in one piece of semiconductor, extremely compact form is obtained with a packing factor of as much as 1000 times larger than that found in conventional integrated circuits of today.
SESSION VI: Switching Circuits I

Chairman: A. W. Lo, RCA Laboratories Div., RCA, Princeton, N. J.

D. E. Lighton, RCA Laboratories Div., RCA, Princeton, N. J.

The sensitive signal amplifying and information-handling capabilities of transistors (emitter, bipolar, and tunnel) and vacuum devices (grid-controlled and beam deflection tubes) of the emitter-control-collector type will be described in a very simple, yet general, manner in terms of charge control, charge storage, and charge accommodation.

6.2: A New Store-High Current, High-Speed, Non-Saturating Transistor Driver
T. F. Abbot, Jr., Bell Telephone Laboratories, Inc., Murray Hill, N. J.

In the design of the access circuitry for twistor stores, it has been found that drivers with current capabilities up to 4% amperes, producing 2-microsecond pulses with rise and fall times of the order of 100-200 millimicroseconds and possessing current regulations of the order of ±5% have been required. A series of nonsaturating circuits which was designed to fill this need is the subject of this paper.

6.3: A New All-Magnetic Logic System Using Simple Cores
D. C. Engelbart, Stanford Research Institute, Menlo Park, Calif.

A method will be described whereby simple magnetic cores, wired into all-ones networks (no diodes, resistors, capacitors), and driven by appropriate clock currents, can transfer binary information states from core to core with stable gains characteristics, and can possess facility for logical manipulation.

6.4: Transistor Pulse Circuits for 100-Mc Clock Rates

Part A—Pulse Regeneration. Circuits have been developed to regenerate high speed digital signals that have been distorted by noise in transmission and hand line amplification. Particular circuits include: (1) A bistable flipflop; (2) a de-exciting amplifier, and (3) a reshaping and regenerating circuit.

Part B—Parallel-to-Serial Multiplexing. Sixteen synchronous 1-b package signals are interfaced in time by transistor gates to produce a regenerated and timed output at 100 Mc.

6.5: Hyperfast Diffused-Silicon Diode and Transistor for Logic Circuits

A new diode and transistor, which represent major advances for logic circuits, are in manufacture. These devices offer great circuit speed plus the usual advantages of diffused-silicon junction units. Logic circuits, using these devices, that achieve economic and reliable operation with propagation delays of 20 to 300 millimicroseconds will be described.

LUNCH: 12:00 Noon to 1:15 P.M.—University Museum

SESSION VII: Solid-State Microwave Electronics II


7.1: Solid State Maser Amplifiers and Their Applications
A. B. Trowbridge, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

The gain-bandwidth product and noise temperature of typical cavity and traveling-wave masers will be described. Maser performance may be characterized by the negative Q and negative temperature of the crystal. These are determined by the resonant magnetic field, the orientation of the rf and dc magnetic fields, the bath temperature and the pumping and amplifying temperatures.

7.2: A Reentrant Resonant-Ring Maser Cavity
J. W. Meyer, MTI, Lincoln Laboratory, Lexington, Mass.

Microwave circuit design problems for cavity type solid-state masers will be reviewed. Some recent results are described. A new circuit, wherein the signal circuit is a circular reentrant cavity and the circumference of the cavity forms a waveguide ring resonant at the pumping frequency, will be detailed. Experimental characteristics will be discussed.

7.3: A Unilateral, Three-Level Maser Employing a Ruby-Loaded Comb-Type Structure

General properties and performance characteristics of a unilateral travelling-wave solid-state maser will be given. The device uses a ruby-loaded comb-type structure. Performance data include forward gain, reverse attenuation, dynamic range for both cw and pulsed signals, bandwidth, electronic tuning range and noise temperature.

7.4: Solid-State Microwave Power Source

Conversion attenuation versus harmonic number for dioded in various modes and noise characteristics for optimum conversion will be discussed. A microwave solid-state system employing a transistor driving a diode multiplier, which has generated 10 milliwatts at 2000 mc with good efficiency, will be described.

7.5: Peromeric Sub-Harmonic Oscillators
F. Sterry and W. R. Beam, RCA Laboratories Div., Princeton, N. J.

Subharmonics oscillators using variable capacitance diodes have been constructed. These oscillators, driven by a 4000- mc source, produce oscillations at 2000 mc. In either of two different stable phases, applications to fast binary scales and random number generators will be discussed.

SESSION VIII: Switching Circuits II


8.1: Inverted Phototransistor as a Switched Modulator

An alloy junction phototransistor operated in the inverted connection mode has been used as a high sensitivity source electrically by a simple access circuit. The leakage current is very nearly independent of the switching operation. Based on these facts, it will be shown that a light-determined ac output, essentially unaffected by dark current variations, can be obtained without using modulated light or thermal-compensating elements.

8.2: A Transistor Power Converter-Amplifier
D. A. Poynter, Electronics Laboratory, General Electric Co., Syracuse, N. Y.

Signal amplification along with power conversion can be obtained in a novel power converter which utilizes both the switching and linear gain properties of the converter switching transistors. The common-emitter, common-base, and common-collector configurations of the power converter-amplifier will be discussed, and some examples of its use as a combined power converter-regulator employing either series regulation or high efficiency switch-type regulation will be indicated.

8.3: Physical Principles of Avalanche Transistor Pulse Circuits
O. Johnson, F. Gibbons and W. Shockley, Stanford University, Palo Alto, California

From a simple physical model of the avalanche transistor, a theory has been developed which permits accurate calculation of the significant aspects of its transient performance. The theory has been applied to a relaxation oscillator which embodies many of the features common to avalanche pulse circuits.

8.4: Electrodeposited Twistor and Bit Wire Components
S. J. Schwartz and J. S. Sallo, Magnetic Research Dept., The National Cash Register Co., Dayton, Ohio

Electrodeposition of twistor has been accomplished and similar elements requiring no external stressing (bit wire) have also been prepared. Some common characteristics of these materials are switching speeds of less than 100 millimicroseconds, temperature stability, high signal-to-clutter ratio and transistor operation. Linear selection and coincident current memories have been prepared.

8.5: Rotational Remagnetization of Thin Films

The internal remanence of a thin ferromagnetic film will be described from the physical viewpoint. The signal propagates in spin waves, the ferromagnetic analogues of the familiar wave-guide modes. The results arise from the coupling of the spin waves to the phonons or heat modes. The influence of the sample shape on the frequency of the spin-waves and on the spin-wave-to-phonon coupling can be pictorialized in a simple intuitive fashion.
Scope of Conference

The 1959 Solid-State Circuits Conference will feature eight sessions devoted to broad advances in the field of solid-state device applications and circuits. Forty papers will be offered covering new magnetic and semiconductor devices and circuits for digital storage and logic. Also presented will be a number of survey reports on low-temperature electronics, microwave masers and parametric amplifiers.

Informal discussion sessions, conducted by leaders in the solid-state field, will be held on Thursday evening to provide registrants an opportunity to discuss logic circuits, memory, high-frequency linear techniques, solid-state microwave electronics, microminiaturization, reliability, high-power techniques and dc amplification.

A 112-page Technical Digest, containing substantial abstracts and a complement of illustrations of every technical paper, will be furnished without charge to every registrant.

Location

The Conference will be held on the campus of the University of Pennsylvania in the Irvine Auditorium and in the University Museum.

Irvine Auditorium is located at the northwest corner of 34th and Spruce Streets; the University Museum is just east of the southeast corner of 34th and Spruce Streets, Philadelphia, Pennsylvania. Central Philadelphia is easily reached by bus route 42 and the 30th Street station of the Pennsylvania Railroad is less than a mile from the University Campus.

The InFormal Thursday evening sessions will be held in the Sheraton Hotel.

Accommodations

The Sheraton Hotel, 1725 Pennsylvania Boulevard (in central Philadelphia), Conference headquarters, has reserved a block of rooms for those attending the Conference. Offices of most major airlines are within one-half block of the hotel; several are in the lobby of the hotel. Railroads to all points are convenient to the hotel; ample indoor parking facilities are available via an underground concourse.

The Cocktail Party and Buffet Dinner will be held at the Sheraton on Thursday evening.

Luncheons on Thursday and Friday will be served to a limited number in the University Museum. For those who do not wish to attend the luncheons or buffet dinner, there are a number of fine restaurants in the area.

Registration

Registration and hotel reservation forms are enclosed with this Conference announcement. Additional forms may be obtained from Harris Colehower, General Electric Co., 3198 Chestnut St., Philadelphia 4, Pa.

Conference fees are:

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Full-time students will be registered free of charge for the technical sessions.

All technical sessions will start promptly at 9:00 A.M. on Feb. 12 and 13. To avoid delays in registration and to assist the local arrangements committee, advance registration and meal purchases are strongly recommended.

Program Committee

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1959 SOLID-STATE CIRCUITS CONFERENCE

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