

TABLE OF CONTENTS

Personnel		vi
Publications and Reports		ix
Introduction		xiii
I.	Physical Electronics	1
	Physical Electronics in the Solid State	1
	Hall Effect in Lead-Sulfide Films	1
	Surface States on Semiconductors	1
	Gaseous Discharges	2
	Ion Generation, Electron Energy Distributions, and Probe Measurements in a Low-Pressure Mercury Arc	2
	Experimental Techniques	3
	Measurement of the X-Ray Limit in Ionization Gauges	3
	Use of Evaporated Metals as Getters	4
	The Spectral Emissivity of Tungsten	4
II.	Microwave Gaseous Discharges	7
	High-Density Microwave Plasma	7
	Pulse Breakdown in Gases	8
III.	Low Temperature Physics	10
	Hexagonal Close-Packed Metals	10
IV.	Microwave Spectroscopy	12
	Molecular-Beam Microwave Spectroscopy	12
	Paramagnetic Resonance	12
	Microwave Frequency Measurement	13
	Micromodulator	14
V.	Nuclear Magnetic Resonance and Hyperfine Structure	15
	Magnetic Field Homogeneity	15
	Nuclear Magnetic Resonance in Solids	15
	Molecular Motion in Cobalt Complexes	15
	The Rotation of Methyl Groups in Solid Acetylenic Hydrocarbons	16
	Chemical Shifts in Aromatic Compounds	16
	Isotope Shift between Mercury ¹⁹⁷ and ^{197*}	17
	Hyperfine Structure of the ³ P ₁ State of Mercury by Double- Resonance Methods	20
	In a Magnetic Field	20
	In Zero Magnetic Field	20

CONTENTS

VI.	Microwave Electronics	22
	Noise	22
	Noise Measurements	22
	Low-Noise Traveling-Wave Tube at 500 Mc	22
	Noise Measure of a Transistor	22
	High-Power Microwave Tubes	23
	Multiple-Cavity Klystrons	23
	A Synchrotron Injection System	24
	Techniques	26
VII.	Atomic Beams	27
	Measurement of the Velocity of Light	27
	Measurements of Variations of the Index of Atmospheric Refraction	30
VIII.	Statistical Communication Theory	32
	A Theory of Nonlinear Systems	32
	A Unified Theory of Information	32
	Outline of Lebesgue Theory	32
	Statistical Application of Flow Graphs – Mean Occurrence of a Markov State	32
	Formulation of Cascade Circuits in Terms of Flow Graphs	35
	Properties of Second-Order Correlation Functions	42
	Theory of Network Synthesis	44
	Some Results in the Cerrillo Theory of Network Synthesis	44
	Level Selector Tube	49
IX.	Processing and Transmission of Information	52
	Row Assignments in Sequential Switching Circuits	52
	Coding for Binary Symmetric Channel	56
X.	Transistor Circuits	57
	A Sensory Aid with Transistors	57
XI.	Noise in Electron Devices	60
	Experimental Examination of the Moments of Semiconductor Noise	60
XII.	Irreversible Thermodynamics	61
XIII.	Mechanical Translation	64
	On the Limits of Finite-State Description	64

CONTENTS

XIV.	Sensory Replacement	66
	Optical Probe	66
	Travel Aid Optical System	66
	Vocatac	66
XV.	Communications Biophysics	69
	Amplitude and Latency Measuring Instrument with Digital Output (ALMIDO)	69
	Equal Loudness Judgments for Monotic and Diotic Clicks	73
	Equal Loudness Judgments for Clicks and Broadband Noise	75
	Effect of Varying Noise Level on a Reader's Voice Level	78
	Average Reaction Times to Pure Tones as a Function of Average Information	79
XVI.	Network Synthesis	81
	Second-Order Saddlepoints on the Riemann Sphere	81
XVII.	Microwave Theory	83
	Use of 4×4 Real Matrices in Microwave Theory	83
	Cascading Two Terminal-Pair Networks by the Isometric Circle Method	85
	Impedance Transformations of the Nonloxodromic Type	87
XVIII.	Circuit Theory	90
	RC Bridge Oscillators	90
	Design of a Cathode-Ray Tube for High-Speed Analog Multiplication	94
	Some Limitations of Amplifying Devices	96