

TABLE OF CONTENTS

	Personnel	vi
	Publications and Reports	ix
	Introduction	xiii
I.	Physical Electronics	1
	Electron Emission Problems	1
	The Static Characteristic Equation for a Triode	1
	Thermionic Emission from a Planar Molybdenum Crystal	4
	Physical Electronics in the Solid State	5
	Surface States on Semiconductors	5
	Temperature Dependence of the Resistance of Germanium PN Junctions	7
	Experimental Techniques	7
	Spectral Emissivity of Tungsten	7
	High-Vacuum Studies	13
II.	Microwave Gaseous Discharges	14
	Microwave Plasma Conductivity	14
	Highly Ionized Plasmas	16
	High-Current Proton Source	16
III.	Solid State Physics	18
	Elastic Constants of Magnesium	18
	Recombination of Electrons and Donors in Germanium	20
IV.	Microwave Spectroscopy	22
	Molecular-Beam Microwave Spectroscopy	22
	Molecular Beams of Alkali Halides	23
	Versitron	24
	Interactions between Torsional and Over-All Rotations in Symmetric-Top Molecules	24
	Paramagnetic Resonance	25
	Atomic Recombinations	26
	Micromodulator	26
	Traveling-Wave Cavity	27
	Permanent Magnets	27
V.	Nuclear Magnetic Resonance and Hyperfine Structure	29
	Atomic-Beam Light Sources	29
	Multiple Quantum Transitions in Magnetic-Moment Interactions	35

CONTENTS

VI.	Microwave Electronics	40
	Theory of Coupling of Modes in Lossless Uniform Cylindrical Systems	40
	Multicavity Klystrons	45
	Electrolytic Tank Studies	46
	Seven-Cavity, Stagger-Tuned, Hollow-Beam Klystron	47
	Introduction	47
	Hollow-Beam Gun	49
	Focusing Magnet	50
	Low-Q Intermediate Cavities	50
	Low-Q Input Cavity	51
	Electron-Stimulated Ion Oscillations	51
	Hydrogen Processing of Stainless Steel (Sec. XX)	170
VII.	Frequency Modulation	54
	Regenerative Feedback Around the Limiter	54
	FM Transients	57
VIII.	Statistical Communication Theory	60
	Analytic Nonlinear Systems	60
	Invariance of Correlation Functions Under Nonlinear Transformations	69
	A Theory of Signals	73
	An Analog Probability Density Analyzer	81
	On the Synthesis of Linear Systems for Pure Transmission, Delayed Transmission, and Linear Prediction of Signals	84
IX.	Process Analysis and Synthesis	100
X.	Processing and Transmission of Information	106
	Information Flow Pattern in a Rectangular Array of Cells	106
	Theorem on Symmetric Switching Functions	106
	Discrete Noiseless Coding	108
XI.	Transistor and Diode Studies	121
	Temperature Coefficient of Silicon Junction Transition Capacity	121
	Temperature Dependence of Forward-Biased Junction Diodes	122
	Crystal Admittance Measurements	124
	Point-Contact Diode Static Characteristics	125
XII.	Speech Analysis	127
	Studies of Pitch Periodicity	127
	Variations of Formant Intensity with Pitch	131

CONTENTS

XIII.	Mechanical Translation	133
	Structural Grammars	133
XIV.	Communications Biophysics	135
	Responses at the Auditory Cortex to Repetitive Acoustic Stimuli	135
	A Versatile Stimulus Programming Device	140
XV.	Neurophysiology	142
	Membrane Properties	142
	Other Recent Work	144
XVI.	Circuit Theory	146
	Some Limitations of Linear Amplifiers	146
XVII.	Network Synthesis	152
	Transient Correction with All-Pass Networks	152
XVIII.	Microwave Theory	153
	Use of Non-Euclidean Geometry Models	153
	Elementary Network Theory from an Advanced Geometric Standpoint	161
XIX.	Statistical Thermodynamics	166
	Outline of Project	166
	Generalized Phase Rule and Superfluidity	167
XX.	Shop Notes	170
	Hydrogen Processing of Stainless Steel	170