

Recent Papers by IBM Authors

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• Journals

Process Control of Gold and Rhodium Plating Thickness on Very Small Samples by X-ray Spectroscopy, G. H. Glade (CD Burlington), *Advances in X-Ray Analysis* **11**, 185-190 (October 11, 1968).

M-Chloroperbenzoic Acid as a Reagent for the Determination of Unsaturation in Natural and Cyclized Rubber, E. Gipstein (RES Yorktown Hts.), F. Nichik and J. A. Offebach (CD E. Fishkill), *Analytica Chimica Acta* **43**, No. 1, 129-131 (October, 1968).

Pole Approximation in Potential Scattering, H. Morawitz (RES San Jose), *Annals of Physics* **50**, No. 1, 1-5 (October 15, 1968).

Laser Wavelength Selection, T. Harris and T. Y. Tao (SDD Poughkeepsie), *Applied Optics* **7**, No. 11, 2226-2231 (November, 1968).

Multiple Display of Interferograms, O. Bryngdahl, (RES San Jose, *Applied Optics* **7**, No. 11, 2322-2323 (November, 1968).

Tunneling in Metal-Glass-Silicon Structures, R. B. Laibowitz (RES Yorktown Hts.), *Applied Physics Letters* **13**, No. 7, 221-222 (October 1, 1968).

Cataloging Data Stored on Roll Microfilm, R. R. Willets (SDD Poughkeepsie), *ARMA Quarterly* **2**, No. 4, 17-20 (October, 1968).

FORMAC Language and its Application to Celestial Mechanics, A. R. LeSchack and P. Sconzo (FSD Cambridge), *Astronomical Journal* **73**, No. 3, 217-220 (April, 1968).

Viewing Conditions for Classroom TV: An Objective Study, A. S. Neal (ASDD Los Gatos), *Audiovisual Instruction* **13**, No. 7, 706-709 (September, 1968).

Decidability of Second-order Theories and Automata on Infinite Trees, M. O. Rabin (RES Yorktown Hts.), *Bulletin of the American Mathematical Society* **75**, No. 5, 1025-1029 (September, 1968).

A General-purpose Display Processing and Tutorial System, K. J. Engvold and J. L. Hughes (DPD Poughkeepsie), *Communications of the ACM* **11**, No. 10, 697-702 (October, 1968).

Binary Synchronous Communication, J. W. Cullen (SDD Raleigh), *Computer Design* **7**, No. 10, 40-45 (October, 1968).

Machine-generated Speech, W. D. Van Gieson and W. D. Chapman (SDD Raleigh), *Computers and Automation* **17**, No. 11, 31-34 (November, 1968).

Some Best Polynomial Approximations in the Plane, T. J. Rivlin and B. Weiss (RES Yorktown Hts.), *Duke Math. Journal* **35**, No. 3, 475-482 (September, 1968).

Unique Technique Expands Programmable Digital Clock Capabilities, J. A. Dickerson and N. L. Walters (SDD Raleigh), *EDN* **13**, No. 12, 112, 114 (October, 1968).

Infrared Measurement of an Enclosed Rotating Body, J. D. Mattingly (SDD Boulder), *Electromechanical Design* **12**, No. 11, 47-50 (November, 1968).

Eine formale Sprache aus dem Jahr 1907 von Leonardo Torres y Quevedo zur Beschreibung von Maschinen (A formal language of the year 1907 by L. Torres y Quevedo for the description of machines), H. Zemanek, (SDD Vienna), *Elektronische Rechenanlagen* **10**, No. 1, 5-6 (February, 1968).

Abstrakte Objekte (Abstract objects), H. Zemanek (SDD Vienna), *Elektronische Rechenanlagen* **10**, No. 5, 208-217 (October, 1968).

Ein Analogverfahren zur Berechnung der Eigenschaften von Feldeffekttransistoren (An Analog Model of a Schottky-Barrier Field-Effect Transistor), K. E. Drangeid and R. Sommerhalder (RES Zürich), *Helvetica Physica Acta* **41**, No. 6/7, 766-771 (October, 1968).

Magnetically Coupled Impurities in a Linear Chain Heisenberg Ferromagnet, P. Erdös (RES Zürich) and E. Rhodes (Fla. State Univ., Tallahassee), *Helvetica Physica Acta* **41**, No. 6/7, 785-792 (October 20, 1968). P. E. currently at Fla. State Univ.

The Magnetic Red Shift in Europium Chalcogenides, M. H. Freiser, F. Holtzberg, S. Methfessel, G. D. Pettit, M. W. Shafer and J. C. Suits (RES Yorktown Hts.), *Helvetica Physica Acta* **41**, No. 6/7, 832-838 (October, 1968).

Low-energy Electron Diffraction—Circa 1968, F. Jona (RES Yorktown Hts.), *Helvetica Physica Acta* **41**, No. 6/7, 960-964 (October, 1968).

Measurement of the Relaxation Time of the Eastman 9740 Bleachable Dye, J. W. Shelton and J. A. Armstrong (RES Yorktown Hts.), *IEEE Journal of Quantum Electronics* **QE-3**, No. 12, 696-697 (December, 1967).

Properties of New and Useful Tungsten-Bronze Niobates, G. Burns and A. W. Smith (RES Yorktown Hts.), *IEEE Journal of Quantum Electronics* **QE-4**, No. 10, 584-587 (October, 1968).

A Fast Digitalized Scan Laser, M. L. Dakss and C. G. Powell (RES Yorktown Hts.), *IEEE Journal of Quantum Electronics* **QE-4**, No. 10, 648-654 (October, 1968).

Picosecond Integrated Circuits in Germanium and Silicon, F. H. Dill, A. S. Farber and H. N. Yu (RES Yorktown Hts.), *IEEE Journal of Solid State Circuits* **SC-3**, No. 2, 160-162 (June, 1968).

Low-temperature Operation of Ge Picosecond Logic Circuits, E. S. Schlig (RES Yorktown Hts.), *IEEE Journal of Solid State Circuits* **SC-3**, No. 3, 271-276 (September, 1968).

Air-Ground, Ground-Air Communications Using Pseudo-Noise Through a Satellite, H. Blasbalg, H. F. Najjar, R. A. D'Antonio and R. A. Haddad (FSD Gaithersburg), *IEEE Transactions on Aerospace and Electronic Systems* **AES-4**, No. 5, 774-791 (September, 1968).

A Formula for Logical Network Cost, E. Kellerman (SDD Endicott), *IEEE Transactions on Computers* **C-17**, No. 9, 881-884 (September, 1968).

An Analysis of High-speed, Linear-passive Binary, Read-Only Stores, R. L. Gamblin (SDD Endicott), *IEEE Transactions on Computers* **C-17**, No. 9, 889-893 (September, 1968).

A High-speed Threshold Memory Element, R. L. Gamblin and C. J. Tunis (SDD Endicott), *IEEE Transactions on Computers* **C-17**, No. 9, 893-894 (September, 1968).

Single-channel Error Correction in an f-Channel System, M. Y. Hsiao (SDD Poughkeepsie), *IEEE Transactions on Computers* **C-17**, No. 10, 935-943 (October, 1968).

Two-dimensional Small-angle Deflection Theory, C. C. T. Wang (RES Yorktown Hts.), *IEEE Transactions on Electron Devices* **ED-15**, No. 8, 603-612 (August, 1968).

A Survey of Magneto-optic Effects, M. J. Freiser (RES Yorktown Hts.), *IEEE Transactions on Magnetics* **MAG-4**, No. 2, 152-161 (June, 1968).

Memory Core Design and Drive Pulse Optimization using a Change Model of the Storage Core and its Computer Implementation, H. H. El-Sherif and H. F. Koehler (CD Poughkeepsie), *IEEE Transactions on Magnetics* **MAG-4**, No. 2, 193-196 (June, 1968).

Kerr Effects in Thin EuO Films on Mirror Substrates, K. Y. Ahn (RES Yorktown Hts.), *IEEE Transactions on Magnetics* **MAG-4**, No. 3, 408-411 (September, 1968).

Wall Streaming, Creeping, and a New Parade Motion in Ni-Fe Films Excited by Hard-axis Pulses, H. C. Bourne, T. Kusuda (Rice Univ., Houston) and C. H. Lin (CD Burlington), *IEEE Transactions on Magnetics* **MAG-4**, No. 3, 440-445 (September, 1968).

An Investigation of Delta Noise in Square-loop Ferrites, B. Gogos and R. E. Probst (CD Poughkeepsie), *IEEE Transactions on Magnetics* **MAG-4**, No. 3, 565-569 (September, 1968).

Legibility Requirements for Educational Television, A. S. Neal (ASDD Los Gatos), *Information Display* **5**, No. 4, 39-44 (July-August, 1968).

Transport of Electrons in a Strong Built-in Electric Field, J. B. Gunn (RES Yorktown Hts.), *Journal of Applied Physics* **39**, No. 10, 4602-4604 (September, 1968).

Preparation of Garnet Films by Sputtering, E. Sawatzky and E. Kay (RES San Jose), *Journal of Applied Physics* **39**, No. 10, 4700-4706 (September, 1968).

Applications of a Holographic Interference Microscope, P. J. Magill and A. D. Wilson (SDD Endicott), *Journal of Applied Physics* **39**, No. 10, 4717-4725 (September, 1968).

Precision Thermal Expansion Measurements of Semi-insulating GaAs, R. Feder and T. B. Light (RES Yorktown Hts.), *Journal of Applied Physics* **39**, No. 10, 4870-4871 (September 1968).

Properties of GaP Green-light-emitting Diodes Grown by Liquid-phase Epitaxy, K. K. Shih and G. D. Pettit (RES Yorktown Hts.), *Journal of Applied Physics* **39**, No. 11, 5025-5029 (October, 1968).

Magnetic and Magneto-optic Properties of EuO Films Doped with Trivalent Rare-earth Oxide, K. Y. Ahn and T. R. McGuire (RES Yorktown Hts.), *Journal of Applied Physics* **39**, No. 11, 5061-5065 (October, 1968).

Dominant Surface Electronic Properties of SiO₂-passivated Ge Surfaces as a Function of Various Annealing Treatments, T. O. Sedgwick (RES Yorktown Hts.), *Journal of Applied Physics* **39**, No. 11, 5066-5077 (October, 1968).

Measurement of Silicon Dioxide Films Over Small Geometries, L. J. Fried and H. A. Froot (CD E. Fishkill), *Journal of Applied Physics* **39**, No. 12, 5732-5735 (November, 1968).

Word Legibility as a Function of Letter Legibility with Word Size, Word Familiarity and Resolution as Parameters, R. L. Erdmann and A. S. Neal (ASDD Los Gatos), *Journal of Applied Psychology* **52**, No. 5, 403-409 (October, 1968).

On the Independence of Real-time Definability and Certain Structural Properties of Context-free Languages, A. L. Rosenberg (RES Yorktown Hts.), *Journal of the Association for Computing Machinery* **15**, No. 4, 672-679 (October, 1968).

Correlation Energy in Atomic Systems, V. Degeneracy Effects for the Second Row Atoms, A. Veillard and E. Clementi (RES San Jose), *Journal of Chemical Physics* **49**, No. 5, 2415-2421 (September 1, 1968).

Conditional Discrimination Learning Based Upon Chlor-diazepoxide: Dissociation or Cue?, A. Brown, R. S. Feldman and J. W. Moore (RES Yorktown Hts.), *Journal of Comparative and Physiological Psychology* **66**, No. 1, 211-215 (1968). Investigation supported by the U. S. Public Health Service, Grant NIH-MH-01061.

Crystal Growth of Metastable Quartz Solid Solutions in $\text{MgO-Al}_2\text{O}_3\text{-SiO}_2$ Glasses, H. J. Scheel (RES Zürich), *Journal of Crystal Growth* **2**, No. 6, 411-412 (December, 1968). Work performed at the Institute of Crystallography and Petrography of the Federal Institute of Technology, Zürich.

A Theoretical Model of the Three-point Probe Breakdown Technique, P. A. Schumann, Jr. (CD E. Fishkill), *Journal of the Electrochemical Society* **115**, No. 11, 1197-1203 (November, 1968).

Preparation of Compounds Isomorphous to TlAlF_6 , H. Gladney and G. Street (RES San Jose), *Journal of Inorganic and Nuclear Chemistry* **30**, No. 11, 2949-2953 (November, 1968).

Impact-fatigue Testing of Titanium Alloys, R. D. Weltzin and G. Koves (SDD Rochester), *Journal of Materials* **3**, No. 3, 469-482 (September, 1968).

Nonlinear Effects in Holography, O. Bryngdahl and A. Lohmann (RES San Jose), *Journal of the Optical Society of America* **58**, No. 10, 1325-1334 (October, 1968).

Metarecursively Enumerable Sets and Their Metadegrees, G. C. Driscoll (RES Yorktown Hts.), *Journal of Symbolic Logic* **33**, No. 3, 389-411 (September, 1968).

Infrared Microradiometry—Precision and Accuracy Considerations Applicable to Microcircuit Temperature Measurements, D. D. Griffin (CD E. Fishkill), *Materials Evaluation* **26**, No. 10, 215-220 (October, 1968).

Alkali-Rare Earth Niobates with the Tungsten Bronze-type Structure, B. A. Scott, E. A. Giess, G. Burns and D. F. O'Kane (RES Yorktown Hts.), *Materials Research Bulletin* **3**, No. 10, 831-842 (October, 1968).

Temperature Dependence of the Magnetization of an Amorphous Ferromagnet, C. C. Tsuei, G. Longworth (Cal. Inst. of Tech., Pasadena) and S. C. H. Lin (CD Burlington), *Physical Review* **170**, No. 2, 603-605 (June 10, 1968).

Stable Potential Minima and the Jahn-Teller Interaction, P. Wysleng (Physik Institut der Universität Zürich) and K. A. Müller (RES Zürich), *Physical Review* **173**, No. 2, 327-332 (September 10, 1968).

Antiferromagnetism and the Magnetic Phase Diagram of GdAlO_3 , K. W. Blazey and H. Rohrer (RES Zürich), *Physical Review* **173**, No. 2, 574-580 (September 10, 1968).

Magnetoresistance of Dilute Alloys, H. Rohrer (RES Zürich), *Physical Review* **174**, No. 2, 583-594 (October 10, 1968).

Effects of a Tilted Magnetic Field on a Two-dimensional Electron Gas, F. F. Fang and P. J. Stiles (RES Yorktown Hts.), *Physical Review* **174**, No. 3, 823-828 (October 15, 1968).

Atomic Bethe-Goldstone Calculations, III. Correlation Energies of Ground States of Be, B, C, N, O, F, and Ne, R. K. Nesbet (RES San Jose), *Physical Review* **175**, No. 1, 2-9 (November 5, 1968).

Analysis of the Harris Variational Method in Scattering Theory, R. K. Nesbet (RES San Jose), *Physical Review* **175**, No. 1, 134-141 (November 5, 1968).

Isotope Effect for Diffusion of Iron in Vanadium, M. G. Coleman (Materials Research Laboratory, Univ. of Ill.) and R. F. Peart (RES Yorktown Hts.), *Physical Review* **175**, No. 3, 788-795 (November 15, 1968).

Phonons in Time-dependent Hartree Approximation with Application to Order-disorder Ferroelectrics, P. B. Miller and P. C. Kwok (RES Yorktown Hts.), *Physical Review* **175**, No. 3, 1062-1071 (November 15, 1968).

Calculation of the Self-consistent Phonon Spectrum of hep He^4 , N. S. Gillis (Sandia Laboratory, Albuquerque, N. M.), T. R. Koehler (RES San Jose) and N. R. Werthamer (Bell Telephone Laboratories, Murray Hill, N. J.), *Physical Review* **175**, No. 3, 1110-1115 (November 15, 1968).

Theory of Heat-pulse Propagation in a Phonon Gas, P. C. Kwok (RES Yorktown Hts.), *Physical Review* **175**, No. 3, 1208-1215 (November 15, 1968).

Characteristic Structural Phase Transition in Perovskite-type Compounds, K. A. Müller (RES Zürich), W. Berlinger (RES Yorktown Hts.) and F. Waldner (Physik Institut der Universität Zürich), *Physical Review Letters* **21**, No. 12, 814-817 (September 16, 1968).

Structural Phase Transitions in Perovskite-type Crystals, H. Thomas and K. A. Müller (RES Zürich), *Physical Review Letters* **21**, No. 17, 1256-1259 (October 21, 1968).

Voltage Pulse Modulation of Photoluminescence in p-GaP, K. Weiser (RES Yorktown Hts.), *Physical Review Letters* **21**, No. 18, 1337-1340 (October 28, 1968).

Transverse Hall Effect in the Electric Quantum Limit, F. Stern (RES Yorktown Hts.), *Physical Review Letters* **21**, No. 25, 1687-1690 (December 16, 1968).

Ferrimagnetism in the $\text{RbMg}_{1-x}\text{Co}_x\text{F}_3$ System, M. W. Shafer and T. R. McGuire (RES Yorktown Hts.), *Physics Letters* **27A**, No. 10, 676-677 (October 7, 1968).

Temperature Dependence of the Resonance Linewidth in EuO , D. E. Eastman (RES Yorktown Hts.), *Physics Letters* **28A**, No. 2, 136-137 (November 4, 1968).

Techniques for the Optimal Design and Synthesis of Switching Circuits, G. D. Hachtel and R. A. Rohrer (RES Yorktown Hts.), *Proceedings of the IEEE* **55**, No. 11, 1864-1877 (November, 1967).

Distributed Field-effect Amplifiers, G. Kohn (RES Zürich) and R. W. Landauer (RES Yorktown Hts.), *Proceedings of the IEEE* **56**, No. 6, 1136-1137 (June, 1968). G. K. currently at the Univ. of Stuttgart.

150 Picosecond Germanium Emitter Follower Current Switch Circuit, J. J. De Cillo (RES Yorktown Hts.), *Proceedings of the IEEE* **56**, No. 9, 1608-1609 (September, 1968).

Detection Method for the Normal-to-Superconducting Phase Transition of Ten μ Spheres, D. S. McLachlan and J. Feder (RES Zürich), *Review of Scientific Instruments* 39, No. 9, 1340-1342 (September, 1968). D. S. M. currently at the Univ. of the Witwatersrand, Johannesburg, S. Af.; J. F. now at Fysisk Inst., Univ. of Oslo.

An Optimum Design Problem for the Nonlinear Elastica, I. Tadjbakhsh (RES Yorktown Hts.), *SIAM Journal on Applied Mathematics* 16, No. 5, 964-972 (September, 1968).

Combinatorial Information Retrieval System, D. K. Ray-Chaudhuri (RES Yorktown Hts.), *SIAM Journal on Applied Mathematics* 16, No. 5, 973-992 (September, 1968).

Regulation of Incompletely Identified Linear System, A. Chang and J. Rissanen (RES San Jose), *SIAM Journal on Control* 6, No. 3, 327-348 (August, 1968).

Scheduling and Allocating in a Communication Environment, L. J. Endicott, Jr. and S. Kreger (SDD Raleigh), *Software Age* 2, No. 9, 18, 20-25 (October, 1968).

Correction Factors for the Four-point Probe Resistivity Measurement on Cylindrical Semiconductors, H. H. Gegenwarth (CD E. Fishkill), *Solid State Electronics* 11, No. 10, 787-789 (October, 1968).

Phase-shift Corrections in Determining the Thicknesses of Transparent Films on Reflective Substrates, W. A. Pliskin (CD E. Fishkill), *Solid State Electronics* 11, No. 10, 957-963 (October, 1968).

Measurement Electronics for the Three-point Probe, P. A. Schumann, Jr., J. F. Hallenback, Jr., M. R. Poponiak and C. P. Schneider (CD E. Fishkill), *Solid State Technology* 11, No. 11, 32-36 (November, 1968).

Simplified X-ray Examination of Solid State Devices, S. Lawhorne and J. N. Ramsey (CD E. Fishkill), *Solid State Technology* 11, No. 11, 37-39 (November, 1968).

Quantum Mechanical Calculations on Barriers to Internal Rotation. II. The Borazane Molecule BH_3-NH_3 , A. Veillard (RES San Jose) and M. Moireau (Laboratoire de Chimie, Paris), *Theoretica Chimica Acta* 11, No. 4, 344-357 (August, 1968).

A Comparison of Different Contractions for Molecular Calculations with Gaussian-type Functions, C. Salez and A. Veillard (RES San Jose), *Theoretica Chimica Acta* 11, No. 5, 441-451 (October, 1968).

Transient Axially Symmetric Excitation of a Circular Elastic Rod in Plane Strain, C. W. Nelson (SDD Endicott), *Transactions of the ASME, Journal of Applied Mechanics* 35, No. 2, 302-312 (June, 1968).

Numerical Solution of Transients in Pneumatic Networks—Transmission-Line Calculations, S. Tsao (SDD Endicott), *Transactions of the ASME, Journal of Applied Mechanics* 35, No. 3, 588-595 (September, 1968).

Noah, Joseph, and Operational Hydrology, B. B. Mandelbrot and J. R. Wallis (RES Yorktown Hts.), *Water Resources Research* 4, No. 5, 909-918 (October, 1968).

On the Significance of Surface Fatigue in Sliding Wear, R. G. Bayer and R. A. Schumacher (SDD Endicott), *Wear* 12, No. 3, 173-183 (September, 1968).

Discrete TIG Welds for IBM Computer Components, R. P. Loomis (SMD Boulder), *Welding Engineer* 53, No. 11, 74-76 (November, 1968).

• Book abstract

Transmission Lines for Digital and Communications Networks: An Introduction to Transmission Lines, High Frequency and High Speed Pulse Characteristics and Applications, R. E. Matlick (RES Yorktown Hts.), McGraw-Hill Book Company, New York, 1969, 360 pages. \$14.50.

The purpose of this book is twofold. The first is to provide a means by which those not acquainted with transmission lines can very easily acquire the basic concepts using nothing more than ac circuit analysis. It is also intended as a review for those who have some basic knowledge, or for use as a reference. The second purpose of the book is to present various subjects of interest to the novice as well as the expert which are fundamental in nature and at the same time becoming increasingly important. Many of the subjects, such as superconducting transmissions lines, anomalous skin effects, and pulse transformers, cannot be found in books, but rather, only scattered throughout the literature. Particular emphasis has been placed on high frequency and pulse behavior, although the analyses are quite general with the low frequency case usually being only a special limiting case. Throughout the book, the author has tried to focus on "usefulness," both from a concept point of view by making analyses start from or relate to first principles, and by showing results and comparisons so as to have a greater impact on the reader.

The content of the book proceeds from the basic concepts of transmission lines and wave propagation using only elementary ac theories, to the general theory of velocity of propagation of waves, and then to the classical theory of skin effect, including a discussion of anomalous skin effects, which generally occur at low temperatures. The important characteristics and behavior of transmission lines with pulse excitations are treated in a separate chapter. The "nearly ideal" transmission line made of superconductors is discussed with an attempt to show its fundamental limitations as well as its improved behavior. The fundamental concepts of coupled transmission lines are discussed and analyzed, and the phenomena of directional coupling are considered in detail for various applications. The final chapter of the book brings together the concepts, analyses, and techniques for determining transmission line parameters. Various cases not usually considered in textbooks are presented, and discussions concerning accuracy and high frequency limitations are included.