

Oxford University Press



The Open-mapping and Closed-graph Theorems in Topological Vector Spaces

By TAQDIR HUSAIN, *Southern Illinois University*. The author describes the progress made in extending two of the deepest results of Functional Analysis, "the open-mapping and closed-graph theorems." The opening chapters deal with elementary concepts of topological and vector spaces. The work then goes on to describe recent extensions and related ideas, such as B -completeness and the open-mapping theorem, the ew^* -topology and various notions of completeness, the theory of S -spaces, and locally convex spaces with B -property.

\$4.80

Homographies, Quaternions and Rotations

By PATRICK DUVAL, *University of London*. Bringing together the theories of one-dimensional homographies, of unitary matrices of order 2, of quaternions, of rotations in three and four dimensions, and of regular polyhedra and polytopes, this monograph clarifies the complex relationships and correspondences between these different disciplines. Most of the material has been collected from widely scattered papers, covering writers of different periods and nationalities. Much of the material is not yet in any textbook, and a great deal can properly be called classical. However, there are more modern links with some three-dimensional topological spaces, with the topology of singular points on an algebraic surface, and with involutions in the complex projective plane. 30 text figures.

\$5.60

Infinity

An Essay in Metaphysics

By JOSÉ A. BERNARDETE, *Syracuse University*. In this volume Professor Bernardete presents an original theory of the concept of infinity, in its mathematical as well as in its ontological bearing. He offers a metaphysics of the actual infinite as the solution to the contemporary crisis in the foundations of mathematics. Finitism is attacked in all its forms, philosophical and mathematical, from Aristotle and Kant to Brouwer and Wittgenstein. Such specifically mathematical topics as convergent and divergent series, the transfinite cardinals and ordinals, Gödelian formulas, the continuum and the infinitesimal are investigated in the light of a new approach to Zeno's "bisection" paradox. 7 text figures.

\$7.20

Oxford University Press / New York



Academic Press
in the forefront of scientific publishing

Journal of Differential Equations

editor-in-chief: Joseph P. LaSalle

EDITORIAL BOARD: H. A. Antosiewicz, A. P. Calderon, Mary L. Cartwright, Courtney Coleman, Roberto Conti, Avron Douglis, A. Halanay, Jack K. Hale, Lars Hörmander, S. Lefschetz, T. Ważewski.

- a continuation of *Contributions to Differential Equations*, published for three years under the auspices of RIAS and the University of Maryland
- devoted to both theory and applications and will be addressed not only to mathematicians but to engineers, physicists, and other scientists to whom differential equations are indispensable tools
- will include papers on ordinary differential equations, stochastic differential equations, mathematical control theory, topological dynamics, and other related topics

CONTENTS OF VOLUME 1, NO. 2, APRIL 1965: R. S. BUCY, Stability and Positive Martingales. RICHARD K. MILLER, Asymptotic Behavior of Non-linear Delay-Differential Equations. JUNJI KATO, The Asymptotic Equivalence of Systems of Functional Differential Equations. VIDAR THOMEE, Stability of Difference Schemes in the Maximum Norm. EMILIO ROXIN, Stability in General Control Systems. JANE CRONIN, The Point at Infinity and Periodic Solutions. JOHN E. LAGNESE, A New Differential Operator of the Pure Wave Type. EMILIO O. ROXIN, On Generalized Dynamical Systems Defined by Contingent Equations. IRVING J. EPSTEIN, On Systems of Linear Differential Equations with Periodic Coefficients: Algebraic and Topological Aspects. AVRON DOUGLIS, Properties of Weak Solutions of Generalized Radial Transport Equations.

Volume 1 (Quarterly), 1965

Institutional Subscription: \$15.00

Journal of Algebra

editor-in-chief: Graham Higman

EDITORIAL BOARD: Richard Brauer, R. H. Bruck, D. A. Buchsbaum, P. Cohn, J. Dieudonné, Walter Feit, A. Fröhlich, A. W. Goldie, J. A. Green, Marshall Hall, Jr., Philip Hall, I. N. Herstein, B. Huppert, Nathan Jacobson, E. Kleinfeld, Saunders MacLane, D. Rees, H. J. Ryser, J. Tits, Guido Zappa.

- provides a central medium for the publication of original research articles which are of importance to algebraists
- will emphasize work directly in the field of algebra, though papers from related research areas which have application to algebra will be considered

Volume 2 (Quarterly), 1965

Institutional Subscription: \$14.00

PRIVATE SUBSCRIPTIONS for both these journals are available at a reduced rate on orders placed directly with the Publisher, certifying that the subscription is paid for by the subscriber for his personal use. Sample copies sent upon request.

USE COUPON ON FOLLOWING PAGE TO ORDER THESE JOURNALS

Academic Press NEW YORK AND LONDON. 111 Fifth Avenue, New York 10003

MATHEMATICS • PHYSICS • CHEMISTRY • BIOLOGICAL SCIENCES • MEDICAL RESEARCH
SPACE SCIENCES • ENGINEERING • PSYCHOLOGY



Academic Press

in the forefront of scientific publishing

MATHEMATICS IN SCIENCE AND ENGINEERING

EDITED BY RICHARD BELLMAN

VOLUME 15

Random Processes in Nonlinear Control Systems

by A. A. Pervozvanskii

Translated from the Russian by Scripta Technica, Inc.

- covers a large part of the most important recent research on the mathematical and physical aspects of nonlinear random phenomena in the design of automatic control systems, giving primary attention to systems with inverse coupling
- presents new material, published for the first time

CONTENTS: Nonlinear Transformations without Feedback. Nonlinear Transformations with Feedback Stationary States. Nonlinear Transformations with Feedback Nonstationary States. Extremal Systems. Appendices. *Related Literature. Bibliography. Subject Index.* (P180) May 1965, 341 pp., \$14.00

VOLUME 14

Systems and Simulation

by Dimitris N. Chorafas

- offers the first complete study of the theory and application of mathematical simulation in relation to man-made systems
- presents specific case studies in industrial systems, military operations, traffic and cargo problems, hydraulic applications, and the supplementary use of analog media in scientific investigation
- considers the development and use of mathematical models, gives practical information on the writing and testing of equations and discusses the collection and analysis of data for systems studies

(C280) March 1965, 503 pp., \$14.50

VOLUME 13

Stability of Nonlinear Control Systems

by Solomon Lefschetz

- contains the most recent material on the nonlinear control theory as developed from the stability method of Liapunov
- requires a fundamental grasp of standard vector matrix technique and the basic existence properties of ordinary differential equations.

(L246) March 1965, 150 pp., \$7.50

VOLUME 11

Differential Forms

with Applications to the
Physical Sciences

by Harley Flanders

- "The book is very readable—indeed, enjoyable—and, although addressed to engineers and scientists, should be not at all inaccessible to or inappropriate for the current generation of first year graduate students and bright undergraduates."

—American Mathematical Monthly

(F652) 1963, 203 pp., \$7.50

SEND THIS ORDER FORM TO

**YOUR TECHNICAL
BOOKSELLER**

or

**Academic
Press**

111 FIFTH AVENUE
NEW YORK, N.Y. 10003

No charge for postage and handling on orders accompanied by payment. New York City residents please add 4% sales tax.

PLEASE SEND THE FOLLOWING:

8-65

Journal of Differential Equations *Journal of Algebra*
 Institutional Subscription Institutional Subscription
 Private Subscription Private Subscription
 C280 F652 L246 P180

NAME

ADDRESS

CITY STATE ZIP

Remittance enclosed Bill me

Send more information on the following books (use code numbers):

5-65

From the HOLDEN-DAY Library of Science and Technology

Elements of Finite Probability by *J. L. Hodges, Jr. and E. L. Lehmann*

Provides an introduction to the theory of probability at the pre-calculus level, assuming only a knowledge of high-school algebra. The book gives a rigorous treatment of the basic concepts of probability, including random variables, expectation, and variance. Particular attention is paid to the construction and meaning of probability models. Treatment of the material is restricted to the finite case, including the normal and Poisson approximations to certain finite probabilities. Numerous illustrations are drawn from various fields. \$4.75

Elements of General Topology by *Sze-Tsen Hu*

An introductory first course on general topology for advanced undergraduates and graduates in mathematics. The first three chapters emphasize basic concepts, fundamental properties, and important constructions; the last three chapters are devoted to specific topological topics, which either have not yet appeared in book form or appear only in advanced treatises. \$8.75

Elementary Analysis by *Richard F. McCoart, Malcolm W. Oliphant, and Anne E. Scheerer*

An introductory text providing a logical, rather than an intuitive, "problems" approach to the basic concepts of the calculus. The book thoroughly covers a number of carefully selected topics, with emphasis on accurate mathematical reasoning. It is particularly appropriate for courses dealing with the concepts or ideas of the calculus for liberal arts students, or the new curriculum teacher training. It can be used, as well, as the first text in the usual calculus sequence for mathematics and science majors. \$7.95

For a complete catalog, write to:

HOLDEN-DAY, INC., 728 Montgomery Street, San Francisco 94111

**MEMOIRS
Number 52**

**GALOIS THEORY AND COHOMOLOGY
OF COMMUTATIVE RINGS**

By S. U. Chase, D. K. Harrison, and A. Rosenberg

This Memoir consists of three related papers: "Abelian Extensions of Commutative Rings," "Galois Theory and Galois Cohomology of Commutative Rings," and "Amitsur Cohomology and the Brauer Group."

In the first paper the main theorems of Galois theory for fields are generalized to commutative rings.

In the second paper, the Brauer group $B(S/R)$ of Azumaya R -algebras split by S , where S is a finitely generated faithful projective commutative R -algebra, is described cohomologically.

In the third paper the set of all Galois extensions of a commutative ring with a given Abelian Galois group is shown to be a group. Using this result, a compact Abelian group is associated to each commutative ring in a manner which generalizes the absolute Abelian Galois group of fields. This group is studied in a Kummer theory for rings.

List Price \$1.80

84 pages

Member Price \$1.35

**Order from
American Mathematical Society
190 Hope Street, Providence, Rhode Island 02906**

Journals Published by the American Mathematical Society

Soviet Mathematics—Doklady

SOVIET MATHEMATICS—DOKLADY is a translation journal containing the entire pure mathematics section of the DOKLADY AKADEMIĀ NAUK SSSR, the Reports of the Academy of Sciences of the USSR. The DOKLADY for a year contains more than 500 articles, each about 4 pages long. Issued bimonthly in January, March, May, July, September, and November.

Subscriptions, \$35.00.

Single issues are \$7.00. Vols. 1, 2, 3, and 4 (1960–1963), price per volume \$40.00.

Mathematical Reviews

This journal is devoted to abstracts and reviews of the current mathematical literature of the world. Two volumes of MATHEMATICAL REVIEWS will be published in 1965, Volume 29 and Volume 30. Each volume will consist of 6 regular issues plus an index issue. In each regular issue the abstracts and reviews are grouped under subject headings. Publication began in 1940. Subscription price per volume of 7 issues is \$50.00; 2 volumes per year \$100.00.

Prior to 1961 it appeared in eleven single issues. Orders for complete volumes only are accepted. Volumes 1–24 are available at the following prices: Vols. 1–16 (1940–1955), \$42.00 each; all other volumes \$50.00.

Notices of the American Mathematical Society

This journal announces the programs of the meetings of the Society. It carries the abstracts of all contributed papers presented at the meetings of the Society and publishes news items of interest to mathematical scientists.

The subscription price is \$7.00 per annual volume of seven numbers. A single copy is \$2.00. Orders for back volumes (back issues of the last two years only are available) at \$14.00 per volume.

All communications should be addressed to the Editor, 190 Hope Street, Providence, Rhode Island 02906. News items and insertions for each issue must be in the hands of the editor on or before the deadline for the abstracts for the papers to be presented in the meetings announced in that issue. These deadlines are published regularly on the back of the title page.

Mathematics of Computation

A journal devoted to original papers in numerical analysis, the application of numerical methods and high-speed calculator devices, the computation of mathematical tables, the theory of high-speed calculating devices and other aids to computation. In addition it publishes reviews and notes in these and related fields. Published by the Society for the National Academy of Sciences–National Research Council.

Prospective publications should be addressed to the Editor, Dr. Harry Polachek, Technical Director, Applied Mathematics Laboratory, David Taylor Model Basin, Washington, D. C. 20007. The author may suggest the name of an editor for review of his paper.

The subscription price is \$16.00 per volume of 4 issues. Single copies are \$2.50. Back issues insofar as they are available: (1943–1964) \$3.00 per issue; \$12.00 per volume. Write for specific information concerning availability.

Chinese Mathematics—Acta

This is a cover-to-cover translation into English of Acta Mathematica Sinica published by Academia Sinica Peking, People's Republic of China. Acta Mathematica Sinica contains current research in all fields of pure mathematics. Subscription price per volume \$20.00.

Volume 1, 1962 of the translation (corresponding to Volume 10, 1960 of the original) contained three issues. Volume 2–4 (1963–1964) contain four issues each.

Back volumes \$30.00; single issue price one third of the volume price.

Journals Published by the American Mathematical Society

Bulletin of the American Mathematical Society

This journal is the official organ of the Society. It reports official acts of the Society and the details of its meetings. It contains some of the officially invited addresses presented before the Society, reviews of advanced mathematical books, research problems and a department of research announcements.

The subscription price is \$7.00 per annual volume of six numbers.

Research Problems and Invited Addresses offered for publication should be sent to WALTER RUDIN, Department of Mathematics, University of Wisconsin, Madison, Wisconsin; Book Reviews to FELIX BROWDER, Department of Mathematics, University of Chicago, Chicago, Illinois 60637. Research Announcements offered for publication should be sent to some member of the Council of the Society, and communicated by him to E. H. SPANIER, Department of Mathematics, University of California, Berkeley, California 94720. All other communications to the editors should be sent to the Managing Editor, FELIX BROWDER.

The members of the Council for 1965 are: A. A. Albert, H. A. Antosiewicz, R. F. Arens, Maurice Auslander, Lipman Bers, R. P. Boas, Felix Browder, R. C. Buck, Eugenio Calabi, A. P. Calderon, Lamberto Cesari, P. J. Cohen, P. E. Conner, C. W. Curtis, D. A. Darling, J. L. Doob, G. F. D. Duff, Eldon Dyer, J. W. Green, P. R. Halmos, O. G. Harrold, G. A. Hedlund, M. H. Heins, Edwin Hewitt, Fritz John, Mark Kac, V. L. Klee, Karel de Leeuw, M. M. Loève, G. W. Mackey, W. T. Martin, W. S. Massey, J. W. Milnor, G. D. Mostow, Louis Nirenberg, R. S. Pierce, Everett Pitcher, Alex Rosenberg, Walter Rudin, Dana Scott, Seymour Sherman, I. M. Singer, Stephen Smale, E. H. Spanier, N. E. Steenrod, Michio Suzuki, J. D. Swift, A. E. Taylor, J. V. Wehausen, John Wermer, George Whaples, Daniel Zelinsky, Leo Zippin, Antoni Zygmund.

Proceedings of the American Mathematical Society

This journal is devoted entirely to research in pure and applied mathematics and is devoted principally to the publication of original papers of moderate length. A department called Shorter Notes was established for the purpose of publishing very short papers of an unusually elegant and polished character, for which there is normally no other outlet.

The subscription price is \$11.00 per annual volume of six numbers.

Papers in algebra and number theory should be sent to ALEX ROSENBERG, Department of Mathematics, Cornell University, Ithaca, New York or GEORGE WHAPLES, Department of Mathematics, Indiana University, Bloomington, Indiana; in probability, real variables, logic, and foundations to R. C. BUCK, Department of Mathematics, University of Wisconsin, Madison 6, Wisconsin; in abstract analysis to either R. C. BUCK or ALEX ROSENBERG; in geometry and topology to ELDON DYER, Department of Mathematics, Rice University, Houston 1, Texas; in other branches of analysis, applied mathematics, and all other fields to M. H. HEINS, Department of Mathematics, University of Illinois, Urbana, Illinois, or FRITZ JOHN, Courant Institute of Mathematical Sciences, 4 Washington Place, New York 3, New York. All other communications to the editors should be addressed to the Managing Editor, ELDON DYER.

Transactions of the American Mathematical Society

This journal is devoted entirely to research in pure and applied mathematics, and includes in general longer papers than the PROCEEDINGS.

Four volumes of three numbers each will be published in 1965, as well as three additional volumes (one in two parts). The subscription price is \$8.00 per volume.

Papers in analysis and applied mathematics should be sent to LOUIS NIRENBERG, Courant Institute of Mathematical Sciences, New York University, New York 3, New York; in topology to W. S. MASSEY, Department of Mathematics, Yale University, Box 2155, Yale Station, New Haven, Connecticut; in algebra, number theory, and logic to DANIEL ZELINSKY, Department of Mathematics, Northwestern University, Evanston, Illinois; in geometry and abstract analysis to I. M. SINGER, Department of Mathematics, Massachusetts Institute of Technology, Cambridge 39, Massachusetts; in statistics and probability to MICHEL LOÈVE, Department of Statistics, University of California, Berkeley 4, California; in mathematical logic and foundations to DANA SCOTT, Department of Mathematics, Stanford University, Stanford, California. All other communications to the editors should be addressed to the Managing Editor, MICHEL LOÈVE.

CONTENTS—*Continued from back cover*

Marvin Marcus. Matrix applications of a quadratic identity for decomposable symmetrized tensors.....	360
Martin Schechter. Invariance of the essential spectrum....	365
D. W. Dean. Direct factors of (AL) -spaces.....	368
J. P. May. The cohomology of restricted Lie algebras and of Hopf algebras.....	372
J. P. May. The cohomology of the Steenrod algebra; stable homotopy groups of spheres.....	377
S. A. Andrea. On homeomorphisms of the plane, and their embedding in flows.....	381
Arthur Wasserman. Morse theory for G -manifolds.....	384
C. R. Riehm. Symplectic groups over discrete valuation rings	388
Robert Bonic and John Frampton. Differentiable functions on certain Banach spaces.....	393
Correction.....	396
Addenda.....	396

CONTENTS

March, 1965

Invited Addresses

- J. C. C. Nitsche. On new results in the theory of minimal surfaces. 195
- Harry Furstenberg. Translation-invariant cones of functions on semi-simple Lie groups 271

Book Reviews

- O. T. O'Meara. Introduction to quadratic forms. Reviewed by Ronald Jacobowitz. 327
- S. Sternberg. Lectures on differential geometry. Reviewed by R. Hermann. 332

Research Problems

- Richard Bellman. Some problems concerning convolutions . 338
- D. Suryanarayana. Research problems in theory of numbers . 338
- Report of the Treasurer. By A. E. Meder, Jr. 339

Research Announcements

- F. E. Browder. Principal functions for elliptic systems of differential equations. 342
- Takashi Ono. The Gauss-Bonnet theorem and the Tamagawa number 345
- L. A. Rubel and A. L. Shields. Weak topologies on the bounded holomorphic functions. 349
- F. E. J. Linton. The obstruction to the localizability of a measure space. 353
- G. J. Porter. A generalization of the Hilton-Milnor theorem 357

Continued on inside back cover