PROCEEDINGS

OF THE

AMERICAN MATHEMATICAL SOCIETY

EDITED BY

FRED G. BRAUER GLEN E. BREDON

JACOB FELDMAN RICHARD R. GOLDBERG W. WISTAR COMFORT JOSEPH J. ROTMAN

GEORGE B. SELIGMAN

WITH THE COOPERATION OF

THOMAS A. CHAPMAN RONALD G. DOUGLAS JAY R. GOLDMAN

JAMES D. KUELBS BARBARA L. OSOFSKY ROBERT I. SOARE

Coden: PAMYAR **VOLUME 40** NUMBER 1

PAGES 1-332 SEPTEMBER 1973 WHOLE No. 171

Published by the AMERICAN MATHEMATICAL SOCIETY PROVIDENCE, RHODE ISLAND

Proceedings of the American Mathematical Society

This Journal is devoted entirely to research in pure and applied mathematics, and the publication of original papers of moderate length. The maximum length of an acceptable paper is about 8 printed pages. Since a page of the Proceedings contains about 400 words, a rule of thumb is that under 10 typed pages is probably within the limit, but that over 12 typed pages is probably too long.

SHORTER NOTES. Very short notes not to exceed 1 printed page of an unusual nature are also accepted, and appear under the heading Shorter Notes. Items deemed suitable include an elegant new proof of an important and well-known theorem, an illuminating example or counterexample, or a new viewpoint on familiar results. New results, if of a brief and striking character, might also be acceptable, though in general a paper which is merely very short will not be suitable for the Shorter Notes department.

PREPARATION OF THE MANUSCRIPT. Articles for insertion should be typewritten and double spaced. Ditto is not generally satisfactory, although other modes of multiple reproduction may be. The *Manual for Authors*, available from the Society, should be consulted for symbols and style conventions. Authors should take the greatest possible care in preparing the original manuscript. Hand drawn symbols are satisfactory, if clearly done; directions to the printer should be included where necessary on a separate sheet, not in the accompanying letter. Authors must keep a complete copy of their manuscript, and editors will acknowledge receipt; manuscripts can therefore be sent by ordinary mail and any other kind (registered, certified) is entirely unnecessary. Submission of two copies of the manuscript is desirable.

FORM OF MANUSCRIPT. The first page should consist of a descriptive title, followed by an abstract which summarizes the article in language suitable for workers in the general field (algebra, analysis, etc.). The descriptive title should be short, but informative; useless or vague phrases such as "some remarks about" or "concerning" should be avoided. Also avoid proper names unless mathematical usage associates them with the work. The abstract should be at least one complete sentence, and at most 150 words. Included with the footnotes to the paper, but placed before the first footnote, there should be first the AMS (MOS) subject classification numbers representing the primary and secondary subjects of the article. This may be followed by a list of key words and phrases describing the subject matter of the article and taken from it. The AMS (MOS) Subject Classification Scheme (1970) with instructions for its use can be found as an appendix to Mathematical Reviews, Index to Volume 39 (June 1970). See the June 1970 Notices for more details, as well as illustrative examples.

SUBMISSION OF MANUSCRIPTS, REPRINTS AND ADDRESS CHANGES. See the last page of this issue.

GALLEY PROOF. When a paper with more than one author has been accepted for publication, only one set of galley proof will be sent. Joint authors should, therefore, indicate which of them should receive galley proof in the event that the manuscript is accepted for publication.

BACKLOG: None. Two-thirds of the papers currently being received by the editors will be published in 8-11 months.

Subscription information. Five volumes are planned for 1973; the subscription price is \$100. Back number prices are as follows: Volumes 1–16, \$14 per volume, Volumes 17–19, \$18 per volume; Volumes 20–26, \$30 per volume; Volumes 27–30, \$27 per volume; Volumes 31–40, \$30 per volume.

THE PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY is published monthly. Subscriptions, orders for back numbers and inquiries in regard to nondelivery of current numbers should be addressed to the American Mathematical Society, P.O. Box 6248, Providence, R.I. 02904.

Second-class postage paid at Providence, Rhode Island, and additional mailing offices.

Copyright © American Mathematical Society 1973 Printed in the United States of America

PROCEEDINGS

OF THE

AMERICAN MATHEMATICAL SOCIETY

EDITED BY

FRED G. BRAUER

JACOB FELDMAN

GLEN E. BREDON

RICHARD R. GOLDBERG

W. WISTAR COMFORT JOSEPH J. ROTMAN

GEORGE B. SELIGMAN

WITH THE COOPERATION OF

THOMAS A. CHAPMAN RONALD G. DOUGLAS JAY R. GOLDMAN

JAMES D. KUELBS BARBARA L. OSOFSKY ROBERT I. SOARE

VOLUME 40 SEPTEMBER—OCTOBER 1973

Published by the AMERICAN MATHEMATICAL SOCIETY PROVIDENCE, RHODE ISLAND



RESEARCH AND REVIEW 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, and a department of research announcements.

The current issue of the journal lists editors to whom prospective publications should be addressed. Publication is bimonthly.

Transactions of the American Mathematical Society

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

The current issue of the journal lists editors to whom prospective publications should be addressed.

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.

Prospective publications should be addressed to the Editor, Professor Eugene Isaacson, Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, New York 10012. The author may suggest the name of an editor for review of his paper.

Mathematical Reviews

This journal is devoted to abstracts and reviews of the current mathematical literature of the world. Currently publication is monthly; two volumes are published each year, each volume consisting 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.

Soviet Mathematics—Doklady

This bimonthly is a translation journal containing the entire pure mathematics section of the Doklady Akademii Nauk SSSR, the Reports of the Academy of Sciences of the USSR. The Doklady for a year contains about 500 articles, each about 4 pages long.

Mathematics of the USSR-Izvestija

This journal is a cover-to-cover translation of IZVESTIJA AKADEMII NAUK SSSR SERIJA MATEMATIČESKAJA, published bimonthly by the Academy of Sciences of the USSR. It is a journal of current research in all fields of pure mathematics. The translation is published bimonthly starting with Volume 1, Number 1, January-February 1967.

Mathematics of the USSR—Sbornik

This journal is a cover-to-cover translation of MATEMATIČESKIĬ SBORNIK (New Series), published monthly by the Moscow Mathematical Society and the Academy of Sciences of the USSR. It is a journal of current research in all fields of pure mathematics. The translation is published monthly starting with Volume 1, Number 1, January 1967.

Submission of Manuscript

Send papers directly to one of the editors listed under the subject field of the paper.

Algebra and algebraic number theory.

BARBARA L. OSOFSKY, Department of Mathematics, Rutgers University, New Brunswick, New Jersey 08903

JOSEPH J. ROTMAN, Department of Mathematics, University of Illinois, Urbana, Illinois 61801

GEORGE B. SELIGMAN, Department of Mathematics, Yale University, New Haven, Connecticut 06520

Modern or classical analysis and analytic number theory.

Ronald G. Douglas, Department of Mathematics, State University of New York at Stony Brook, Stony Brook, New York 11790

JACOB FELDMAN, Department of Mathematics, University of California, Berkeley, California 94720

RICHARD R. GOLDBERG, Department of Mathematics, University of Jowa Jowa City

RICHARD R. GOLDBERG, Department of Mathematics, University of Iowa, Iowa City, Iowa 52240

Algebraic geometry.

GEORGE B. SELIGMAN, Department of Mathematics, Yale University, New Haven, Connecticut 06520

Set-theoretic and general topology.

THOMAS A. CHAPMAN, Department of Mathematics, University of Kentucky, Lexington, Kentucky 40506

W. WISTAR COMFORT, Department of Mathematics, Wesleyan University, Middletown, Connecticut 06457

Algebraic topology and all other types of geometry.

GLEN E. BREDON, Department of Mathematics, Rutgers University, New Brunswick, New Jersey 08903

Applied mathematics, differential equations, and related areas of analysis.

Fred G. Brauer, Department of Mathematics, University of Wisconsin, Madison, Wisconsin 53706

Probability, statistics, and related fields.

James D. Kuelbs, Department of Mathematics, 213 Van Vleck Hall, University of Wisconsin, Madison, Wisconsin 53706

Logic, set theory, and related areas.

ROBERT I. SOARE, Department of Mathematics, University of Illinois at Chicago Circle, Chicago, Illinois 60680

Combinatorics and related areas of discrete mathematics.

JAY R. GOLDMAN, School of Mathematics, University of Minnesota, Minneapolis, Minnesota 55455

All other communications should be addressed to the Managing Editor, JOSEPH J. ROTMAN, at the above address.

Reprints and Address Changes

Any inquiries concerning a paper which has been accepted for publication, including information regarding reprints or changes of address for mailing proof, should be sent directly to the Editorial Department, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02904.

CONTENTS—Continued from back cover

An approximation theory for oscillations of differential equations. By John	159
GREGORY	166
On the zeros of certain confluent hypergeometric functions. By P. WYNN	173
A Kneser theorem for Volterra integral equations. By WALTER G. KELLEY	183
Some regularity theorems for typically real functions. By George B. LEEMAN, JR.	191
Planar Fourier transforms and Diophantine approximation. By R. KAUFMAN	199
	205
Equations which characterize inner product spaces. By DAVID A. SENECHALLE	209
A remark on C_{σ} spaces. By Simeon Reich	215
Continuity of linear fractional transformations on an operator algebra. By J. WILLIAM HELTON	217
Nonlinear oscillation of a sublinear delay equation of arbitrary order. By Takaŝi Kusano and Hiroshi Onose	219
Inversion of normal operators by polynomial interpolation. By J. C. Dunn	225
Two ergodic theorems for convex combinations of commuting isometries. By S. A.	
McGrath	229
D. Croverny	
D. Geometry	
A characterization of convex surfaces which are L-sets. By E. O. Buchman and	
F. A. Valentine	235
Some totally real minimal surfaces in CP^2 . By Chorng-Shi Houh	240
Isometric embedding of a compact Riemannian manifold into Euclidean space. By	
Howard Jacobowitz	245
A characteristic extremal property of simplices. By ROLF SCHNEIDER	247
E. LOGIC AND FOUNDATIONS	
Compact \mathscr{G} -Souslin sets are G_{δ} 's. By Eric John Braude	250
G. Topology	
	252
Relations in stable homotopy modules. By Donald W. Kahn	253
Locally compact groups without distinct isomorphic closed subgroups. By D. L.	260
ARMACOST and R. R. BRUNER	260
Schlais' theorem extends to λ connected plane continua. By Charles L. Hago-	265
PIAN	265
A filter characterization of regular Baire spaces. By R. A. McCoy	268
The number of continua. By F. W. Lozier and R. H. Marty	271
Noninvertible knots of codimension 2. By C. KEARTON	274
Compact semigroups with low dimensional orbit spaces. By R. P. HUNTER	277
Locally contractible spaces that are absolute neighborhood retracts. By WILLIAM	200
E. HAVER	280
C-separated sets in certain metric spaces. By R. F. DICKMAN, JR., R. A. McCoy	205
and L. R. Rubin	285
A theorem on the restriction of Type I representations of a group to certain of its	201
subgroups. By ROBERT R. KALLMAN.	291
On the shape of torus-like continua and compact connected topological groups.	207
By James Keesling	297
Free topological groups and the projective dimension of a locally compact abelian	303
group. By John Mack, Sidney A. Morris and Edward T. Ordman	
The cobordism of involutions on orientable manifolds. By R. J. ROWLETT	309
Pontryagin classes of vector bundles over BSp(n). By Duane O'Neill	319
A note on the extension of contractive mappings. By J. L. SOLOMON	323
On a problem of F. Riesz concerning proximity structures. By W. J. Thron	323
An exact sequence calculation for the second homotopy of a knot. II. By M. A.	327
GUTIÉRREZ	321
SHORTER NOTES	
A characterization of realcompact extensions. By Marlon Rayburn	331

CONTENTS*

Vol. 40, No. 1 SEPTEMBER 1973 Whole No. 171

	Page
A. ALGEBRA AND NUMBER THEORY	
Real-linear operators on quaternionic Hilbert space. By N. C. POWERS On valuation rings that contain zero divisors. By JAMES A. HUCKABA Determinantal varieties, monomial semigroups, and algebras associated with	1 9
ideals. By Jacob Barshay On classical quotients of polynomial identity rings with involution. By Louis	16
HALLE ROWEN	23
On the number of field topologies on an infinite field. By JOHN O. KILTINEN Normal subgroups of groups which are products of two Abelian subgroups. By LARRY E. KNOP	30
The projective class group of the fundamental group of a surface is trivial. By KOO-GUAN CHOO.	42
The Hoheisel phenomenon for generalized Dirichlet series. By Carlos Julio Moreno	47
Conjugacy separating representations of free groups. By B. A. F. WEHRFRITZ	52
Extending a Jordan ring homomorphism. By ROBERT LEWAND	57
A correction to "On Fricke moduli". By LINDA KEEN	60
A lifting formula for the Hilbert symbol. By EDWARD A. BENDER More noneuclidian PID's and Dedekind domains with prescribed class group. By	63
PAUL EAKIN and W. HEINZER	66
Symmetric homology over rings containing the rationals. By PATRICK J. FLEURY.	69
A new proof of the construction theorem for Stone algebras. By Tibor Katriňák Beurling generalized prime number systems in which the Chebyshev inequalities	75 79
fail. By R. S. Hall	83
On Prüfer rings as images of Prüfer domains. By Monte B. Boisen, Jr. and	87
MAX D. LARSEN Prime rings with involution whose symmetric zero-divisors are nilpotent. By P. M. COHN	91
On simple injective rings. By Sigurd Elliger	93
B. Analysis	0.5
The solution of an integral equation. By C. Nasim	95
Subalgebras of Douglas algebras. By Kevin Clancey and Wayne Cutrer	102 107
Boundedness properties for semigroups of operators. By Frode Terkelsen	112
Decomposable and spectral operators on a Hilbert space. By Bhushan L. Wadhwa	115
Type II W-* algebras are not normal. By Paul Willig	120
On hyperfinite W-* algebras. By PAUL WILLIG	123
A quadratic eigenvalue problem. By W. M. GREENLEE	
A class of C*-algebras. By Horst Behncke and Wolfgang Bös	128
Some remarks on absolute continuity on groups. By I. GLICKSBERG	135
A note on multivalence of functions of bounded index. By GERD H. FRICKE	140
On a property of rational functions. II. By Q. I. RAHMAN	143
DAVID W. DEAN	146
On L^p norms and the equimeasurability of functions. By Kenneth F. Andersen A note on topological dynamics and limiting equations. By S. M. Shamim Impadi	149
and M RAMA MOHANA RAO	154

^{*} The volume index will contain a mapping showing the correspondence between sections A-G and the AMS (MOS) subject classification numbers.