## Pacific

## Journal of

# Mathematics 

VOLUME XLIX

1973

## PACIFIC JOURNAL OF MATHEMATICS

## EDITORS

Richard Arens (Managing Editor)
University of California Los Angeles, California 90024
R. A. Beaumont

University of Washington
Seattle, Washington 98105
J. DUGUNDJI*

Department of Mathematics
University of Southern California
Los Angeles, California 90007
D. Gilbarg and J. Milgram

Stanford University
Stanford, California 94305

ASSOCIATE EDITORS
E. F. Beckenbach
B. H. Neumann
F. WOLF
K. Yoshida

## SUPPORTING INSTITUTIONS

UNIVERSITY OF BRITISH COLUMBIA
CALIFORNIA INSTITUTE OF TECHNOLOGY UNIVERSITY OF CALIFORNIA MONTANA STATE UNIVERSITY UNIVERSITY OF NEVADA NEW MEXICO STATE UNIVERSITY OREGON STATE UNIVERSITY UNIVERSITY OF OREGON OSAKA UNIVERSITY

UNIVERSITY OF SOUTHERN CALIFORNIA STANFORD UNIVERSITY UNIVERSITY OF TOKYO UNIVERSITY OF UTAH WASHINGTON STATE UNIVERSITY UNIVERSITY OF WASHINGTON

*     * AMERICAN MATHEMATICAL SOCIETY NAVAL WEAPONS CENTER

[^0]
## CONTENTS

Wm. R. Allaway, On finding the distribution function for an orthogonal polinomial set ..... 305
E. Amar, Sur un théorème de Mooney relatif aux fonctions analytiques bornées ..... 311
A. Bigard, Free lattice-ordered modules ..... 1
R. Bolstein and W. Wogen, Subnormal operators in strictly cyclic operator algebras ..... 7
R. M. Brooks, Analytic structure in the spectrum of a natural system ..... 315
H. Busemann and D. E. Glassco II, Irreducible sums of simple multivectors ..... 13
B. Cengiz, On extremely regular function spaces ..... 335
K-N. Chow and M. Glasner, Atoms on the Royden boundary ..... 339
W. W. Comfort and V. Saks, Countably compact groups and finest totally bounded topologies ..... 33
P. F. Duvall, Jr., and J. W. Maxwell, Tame $Z^{2}-a c t i o n s$ on $E^{n}$ ..... 349
M. R. Embry, Maximal invariant subspaces of strictly cyclic operator algebras ..... 45
A. R. Freedman, On the additivity theorem for $n$-dimensional asymptotic density ..... 357
R. Freese and J. B. Nation, Congruence lattices of semilattices ..... 51
E. Fried and G. Grätzer, A nonassociative extension of the class of distributive lattices ..... 59
J. R. Giles and D. O. Koehler, On numerical range of elements of locally m-convex algebras ..... 79
M. Glasner, See K-N. Chow and M. Glasner
D. E. Glassco II, See H. Busemann and D. E. Glassco II
G. Grätzer, See E. Fried and G. Grätzer
J. Griffin and K. McKennon, Multipliers and the group $L_{p^{-}}$ algebras ..... 365
L. Hagopian, Characterizations of $\lambda$ connected plane continua ..... 371
J. C. Helton, Bounds for products of interval functions ..... 377
D. A. Hill, On dominant and codominant dimension of QF-3 rings ..... 93
J. S. Hsia and R. P. Johnson, Round and Pfister forms over $R(t)$ ..... 101
I. M. Isaacs, Equally partitioned groups ..... 109
R. P. Johnson, See J. S. Hsia and R. P. Johnson
A. G. Kartsatos and E. B. Saff, Hyperpolynomial approximationof solutions of nonlinear integro-differential equations . . 117
Ikuo Kayashima, On relations between Nörlund and Riesz means ..... 391
S. Kinoshita, On elementary ideals of $\theta$-curves in the 3 -sphere
and 2-links in the 4-sphere ..... 127
R. B. Kirk, Convergence of Baire measures ..... 135
R. J. Knill, The Seifert and Van Kampen theorem via regular covering spaces ..... 149
D. O. Koehler, See J. R. Giles and D. O. Koehler
A. Kovacs, Homomorphisms of matrix rings into matrix rings ..... 161
Y. K. Kwon, $\widetilde{H D}$-minimal but no HD-minimal ..... 171
E. L. Lady, Slender rings and modules ..... 397
Makoto Maejima, On the renewal function when some of the mean renewal lifetimes are infinite ..... 177
J. J. Martínez, Cohomological dimension of discrete modules over profinite groups ..... 185
Shozo Matsuura, On the LU QI-Keng conjecture and the Bergman representative domains ..... 407
J. W. Maxwell, See P. F. Duvall, Jr., and J. W. Maxwell
S. H. McCleary, The lattice-ordered group of automorphisms ofan $\alpha$-set417
S. H. McCleary, o-2-transitive ordered permutation groups ..... 425
S. H. McCleary, o-primitive ordered permutation groups II. ..... 431
K. McKennon, See J. Griffin and K. McKennon
J. B. Nation, See R. Freese and J. B. Nation
W. K. Nicholson, Semiperfect rings with abelian group of units. ..... 191
L. J. Ratliff, Jr., Three theorems on imbedded prime divisors of principal ideals ..... 199
B. E. Rhoades and A. Wilansky, Some commutants in B(c) which are almost matrices ..... 211
J. P. Riley, Cross-sections of decompositions ..... 219
R. Rochberg, Almost isometries of Banach spaces and moduli of planar domains ..... 445
R. F. Rossa, Radical properties involving one-sided ideals ..... 467
R. A. Rubin, On exact localization ..... 473
E. B. Saff, See A. G. Kartsatos and E. B. Saff
V. Saks, See W. W. Comfort and V. Saks
S. Sribala, On $\Sigma$-inverse semigroups483
H. M. Srivastava, On the Konhauser sets of biorthogonal polinomials suggested by the Laguerre polynomials ..... 489
S. A. Steinberg, Rings of quotients of rings without nilpotent elements ..... 493
K. D. Stroyan, A characterization of the Mackey uniformity $m\left(L^{\infty}, L^{1}\right)$ for finite measures ..... 223
D. M. Sunday, Jr., The self-equivalences of an H-space ..... 507
W. J. Thron and R. H. Warren, On the lattice of proximities of Cech compatible with a given closure space ..... 519
E. G. Thurber, The Scholz-Brauser problem on additive chains ..... 229
F. Uhlig, The number of vectors jointly annihilated by two real quadratic forms determines the inertia of matrices in the associated pencil ..... 537
F. Uhlig, On the maximal number of linearly independent real vector annihilated simultaneously by two real quadratic forms ..... 543
F. Uhlig, Definite and semidefinite matrices in real symmetric matrix pencil ..... 561
A. Villone, Self-adjoint extensions of symmetric differential operators ..... 569
J. Vrabec, Submanifolds of acyclic 3-manifolds ..... 241
P. W. Walker, Adjoint boundary value problems for compactified singular differential operators ..... 265
R. Ware, When are Witt rings group rings? ..... 279
R. H. Warren, See W. J. Thron and R. H. Warren
C. Webb, Tensor and direct products ..... 579
J. V. Whittaker, On normal subgroups of differentiable homeomorphisms ..... 595
A. Wilansky, See B. E. Rhoades and A. Wilansky
J. D. Wine, Paracompactifications using filter bases ..... 285
W. Wogen, See R. Bolstein and W. Wogen ERRATA, ..... 615

# Pacific <br> <br> Journal of <br> <br> Journal of Mathematics 

 Mathematics}
A. Bigard, Free lattice-ordered modules ..... 1
R. Bolstein and W. Wogen, Subnormal operators in strictly cyclic operator algebras ..... 7
H. Busemann and D. E. Glassco II, Irreducible sums of simple multivectors ..... 13
W. W. Comfort and V. Saks, Countably compact groups and finest totally bounded topologies. ..... 33
M. R. Embry, Maximal invariant subspaces of strictly cyclic operator algebras ..... 45
R. Freese and J. B. Nation, Congruence lattices of semilattices. ..... 51
E. Fried and G. Grätzer, A nonassociative extension of the class of distributive lattices. ..... 59
J. R. Giles and D.O. Koehler, On numerical ranges of elements of locally m-convex algebras ..... 79
D. A. Hill, On dominant and codominant dimension of $Q F-3$ rings ..... 93
J. S. Hsia and R. P. Johnson, Round and Pfister forms over $R(t)$. ..... 101
I. M. Isaacs, Equally partitioned groups ..... 109
A. G. Kartsatos and E. B. Saff, Hyperpolynomial approximation of solutions of nonlinear integro-differential equations ..... 117
S. Kinoshita, On elementary ideals of $\theta$-curves in the 3 -sphere and 2-links in the 4-sphere. ..... 127
R. B. Kirk, Convergence of Baire measures ..... 135
R. J. Knill, The Seifert and Van Kampen theorem via regular covering spaces ..... 149
A. Kovacs, Homomorphisms of matrix rings into matrix rings. ..... 161
Y. K. Kwon, $\widetilde{H D}$-minimal but no HD-minimal ..... 171
Makoto Maejima, On the renewal function when some of the mean renewal lifetimes are infinite ..... 177
J. J. Martínez, Cohomological dimension of discrete modules over profinite groups ..... 185
W. K. Nicholson, Semiperfect rings with abelian group of units ..... 191
L. J. Ratliff, Jr., Three theorems on imbedded prime divisors of principal ideals ..... 199
B. E. Rhoades and A. Wilansky, Some commutants in $B(c)$ which are almost matrices ..... 211
J. P. Riley, Cross-sections of decompositions ..... 219
K. D. Stroyan, A characterization of the Mackey uniformity $m\left(L^{\infty}, L^{1}\right)$ for finite measures ..... 223
E. G. Thurber, The Scholz-Brauer problem on addition chains. ..... 229
J. Vrabee, Submanifolds of acyclic 3-manifolds ..... 243
P. W. Walker, Adjoint boundary value problems for compactified singular differential operators ..... 265
R. Ware, When are Witt rings group rings? ..... 279
J. D. Wine, Paracompactifications using filter bases ..... 285

# PACIFIC JOURNAL OF MATHEMATICS 

## EDITORS

Richard Arens (Managing Editor)<br>University of California<br>Los Angeles, California 90024

R. A. Beaumont<br>University of Washington<br>Seattle, Washington 98105

J. Dugundji*<br>Department of Mathematics<br>University of Southern California<br>Los Angeles, California 90007

D. Gilbarg and J. Milgram

Stanford University
Stanford, California 94305

## ASSOCIATE EDITORS

E.F. Beckenbach B. H. Neumann F. Wolf K. Yoshida

## SUPPORTING INSTITUTIONS

UNIVERSITY OF BRITISH COLUMBIA
CALIFORNIA INSTITUTE OF TECHNOLOGY
UNIVERSITY OF CALIFORNIA
MONTANA STATE UNIVERSITY
UNIVERSITY OF NEVADA
NEW MEXICO STATE UNIVERSITY
OREGON STATE UNIVERSITY
UNIVERSITY OF OREGON
OSAKA UNIVERSITY

UNIVERSITY OF SOUTHERN CALIFORNIA STANFORD UNIVERSITY
UNIVERSITY OF TOKYO
UNIVERSITY OF UTAH
WASHINGTON STATE UNIVERSITY
UNIVERSITY OF WASHINGTON
$\stackrel{*}{*} \stackrel{*}{*} \stackrel{*}{*}$ MATHEMATICAL SOCIETY
NAVAL WEAPONS CENTER

The Supporting Institutions listed above contribute to the cost of publication of this Journal, but they are not owners or publishers and have no responsibility for its content or policies.

Mathematical papers intended for publication in the Pacific Journal of Mathematics should be in typed form or offset-reproduced, (not dittoed), double spaced with large margins. Underline Greek letters in red, German in green, and script in blue. The first paragraph or two must be capable of being used separately as a synopsis of the entire paper. Items of the bibliography should not be cited there unless absolutely necessary, in which case they must be identified by author and Journal, rather than by item number. Manuscripts, in duplicate if possible, may be sent to any one of the four editors. Please classify according to the scheme of Math. Rev. Index to Vol. 39. All other communications to the editors should be addressed to the managing editor, or Elaine Barth, University of California, Los Angeles, California, 90024.

50 reprints are provided free for each article; additional copies may be obtained at cost in multiples of 50 .

The Pacific Journal of Mathematics is issued monthly as of January 1966. Regular subscription rate: $\$ 48.00$ a year ( 6 Vols., 12 issues). Special rate: $\$ 24.00$ a year to individual members of supporting institutions.

Subscriptions, orders for back numbers, and changes of address should be sent to Pacific Journal of Mathematics, 103 Highland Boulevard, Berkeley, California, 94708.

PUBLISHED BY PACIFIC JOURNAL OF MATHEMATICS, A NON-PROFIT CORPORATION
Printed at Kokusai Bunken Insatsusha (International Academic Printing Co., Ltd.), 270, 3-chome Totsuka-cho, Shinjuku-ku, Tokyo 160, Japan.

* C. R. DePrima California Institute of Technology, Pasadena, CA 91109, will replace J. Dugundji until August 1974.

Copyright © 1973 by
Pacific Journal of Mathematics
All Rights Reserved


[^0]:    * C. R. DePrima California Institute of Technology, Pasadena, CA 91109, will replace J. Dugundji until August 1974.

