## Pacific

Journal of
Mathematics

## VOLUME CXXI 1986

## PACIFIC JOURNAL OF MATHEMATICS <br> EDITORS

V. S. Varadarajan (Managing Editor)
University of California
Los Angeles, CA 90024
Hebert Clemens
University of Utah
Salt Lake City, UT 84112
Charles R. DePrima
California Institute of Technology
Pasadena, CA 91125
R. Finn

Stanford University
Stanford, CA 94305
Hermann Flaschka
University of Arizona
Tucson, AZ 85721
Ramesh A. Gangolli
University of Washington
Seattle, WA 98195
Robion Kirby
University of California
Berkeley, CA 94720
C. C. Moore

University of California
Berkeley, CA 94720
H. Samelson

Stanford University
Stanford, CA 94305
Harold Stark
University of California, San Diego
La Jolla, CA 92093

## ASSOCIATE EDITORS

R. Arens E. F. Beckenbach B. H. Neumann F. Wolf K. Yoshida (1906-1982)

## SUPPORTING INSTITUTIONS

UNIVERSITY OF ARIZONA UNIVERSITY OF BRITISH COLUMBIA CALIFORNIA INSTITUTE OF TECHNOLOGY UNIVERSITY OF CALIFORNIA MONTANA STATE UNIVERSITY UNIVERSITY OF NEVADA, RENO NEW MEXICO STATE UNIVERSITY OREGON STATE UNIVERSITY

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

## CONTENTS

A - ALGEBRA AND NUMBER THEORY
J. Almeida, Minimal non-permutative pseudovarieties of semi- groups. I ..... 257
J. Almeida, Minimal non-permutative pseudovarieties of semi- groups. II ..... 271
H. Cendra, A normal form and integration in finite terms for a class of elementary functions ..... 51
H. A. Keller, On valued, complete fields and their automorphisms ..... 397
D. W. Masser and P. Shiu, On sparsely totient numbers ..... 407
A. H. Mekler and S. Shelah, w-elongations and Crawley's problem ..... 121
A. H. Mekler and S. Shelah, The solution to Crawley's problem ..... 133
J. M. Ruiz, A remark on fields with the dense orbits property ..... 189
S. Shelah, See A. H. Mekler and S. ShelahP. Shiu, See D. W. Masser and P. Shiu
B - ANALYSIS
O. P. Agrawal, D. N. Clark and R. G. Douglas, Invariant subspaces in the polydisk ..... 1
R. G. Bilyeu, R. R. Kallman and P. W. Lewis, Rearrangements and category ..... 41
J. Bourgain, A problem of Douglas and Rudin on factorization ..... 47
D. N. Clark, See O. P. Agrawal, D. N. Clark and R. G. Douglas
Z. Ditzian, Inverse theorems for multidimensional Bernstein opera- tors ..... 293
R. G. Douglas, See O. P. Agrawal, D. N. Clark and R. G. DouglasK. Fan, The angular derivative of an operator-valued analytic func-tion67
M. Furi and M. P. Pera, A continuation principle for forced oscil- lations on differentiable manifolds ..... 321
G. Gierz, On the Dunford-Pettis property of function modules of abstract L-spaces ..... 73
H. Hecht and D. Milicicić, Character identities and asymptotic be- havior of matrix coefficients of discrete series ..... 357
P. Jakóbczak, The boundary regularity of the solution of the $\bar{\partial}$ - equation in the product of strictly pseudoconvex domains ..... 371
K. Jarosz, Isometries between injective tensor products of Banach spaces ..... 383R. R. Kallman, See R. G. Bilyeu, R. R. Kallman and P. W. Lewis
G. Katz, On polynomial generators in the algebra of complex func- tions on a compact space ..... 83
R. Lange, Duality and asymptotic spectral decompositions ..... 93
A. T.-M. Lau and P. F. Mah, Quasi-normal structures for certain spaces of operators on a Hilbert space ..... 109
P. W. Lewis, See R. G. Bilyeu, R. R. Kallman and P. W. Lewis P. F. Mah, See A. T.-M. Lau and P. F. Mah
R. D. Mauldin, The set of continuous nowhere differentiable func- tions: A correction ..... 119
D. Miličić, See H. Hecht and D. Miličić
M. P. Pera, See M. Furi and M. P. Pera
T. J. Ransford, The spectrum of an interpolated operator and ana- lytic multivalued functions ..... 445
R. Rochberg, Deformation of uniform algebras on Riemann sur- faces ..... 135
A. Uchiyama, On the radial maximal function of distributions ..... 467
J.-M. Wu, On singularity of harmonic measure in space ..... 485
D - GEOMETRY
C. Andradas and J. M. Gamboa, On projections of real algebraic varieties ..... 281
J. M. Gamboa, See C. Andradas and J. M. Gamboa
J. J. Hebda, The collars of a Riemannian manifold and stable isosys- tolic inequalities ..... 339
H. C. Wente, Counterexample to a conjecture of H. Hopf ..... 193
G - TOPOLOGY
C. Bandt and G. Baraki, Metrically invariant measures on locally homogeneous spaces and hyperspaces ..... 13
G. Baraki, See C. Bandt and G. Baraki
M. Barge, Horseshoe maps and inverse limits ..... 29
T. B. Ng, Vector bundles over $(8 k+3)$-dimensional manifolds ..... 427
J. Roitberg, On weak epimorphisms in homotopy theory ..... 183
D. G. Wright, Rigid sets in $E^{n}$ ..... 245

## Pacific Journal of <br> Mathematics

O. P. Agrawal, D. N. Clark and R. G. Douglas, Invariant subspaces in the polydisk ..... 1
C. Bandt and G. Baraki, Metrically invariant measures on locally homogeneous spaces and hyperspaces ..... 13
M. Barge, Horseshoe maps and inverse limits ..... 29
R. G. Bilyeu, R. R. Kallman and P. W. Lewis, Rearrangements and category ..... 41
J. Bourgain, A problem of Douglas and Rudin on factorization ..... 47
H. Cendra, A normal form and integration in finite terms for a class of elementary functions ..... 51
K. Fan, The angular derivative of an operator-valued analytic function ..... 67
G. Gierz, On the Dunford-Pettis property of function modules of abstract $L$-spaces ..... 73
G. Katz, On polynomial generators in the algebra of complex functions on a compact space ..... 83
R. Lange, Duality and asymptotic spectral decompositions ..... 93
A. T.-M. Lau and P. F. Mah, Quasi-normal structures for certain spaces of operators on a Hilbert space ..... 109
R. D. Mauldin, The set of continuous nowhere differentiable functions: A correction ..... 119
A. H. Mekler and S. Shelah, $\omega$-elongations and Crawley's problem ..... 121
A. H. Mekler and S. Shelah, The solution to Crawley's problem ..... 133
R. Rochberg, Deformation of uniform algebras on Riemann surfaces ..... 135
J. Roitberg, On weak epimorphisms in homotopy theory ..... 183
J. M. Ruiz, A remark on fields with the dense orbits property ..... 189
H. C. Wente, Counterexample to a conjecture of H. Hopf ..... 193
D. G. Wright, Rigid sets in $E^{n}$ ..... 245

# PACIFIC JOURNAL OF MATHEMATICS EDITORS 

V. S. Varadarajan (Managing Editor)<br>University of California<br>Los Angeles, CA 90024<br>Hebert Clemens<br>University of Utah<br>Salt Lake City, UT 84112<br>Charles R. DePrima<br>California Institute of Technology<br>Pasadena, CA 91125

C. C. Moore

University of California
Berkeley, CA 94720
H. Samelson

Stanford University
Stanford, CA 94305
Harold Stark
University of California, San Diego
La Jolla, CA 92093

Robion Kirby
University of California
Berkeley, CA 94720

## ASSOCIATE EDITORS

| R. Arens | E. F. Beckenbach |  |  |
| :---: | :---: | :---: | :---: | :---: |
| $(1906-1982)$ | B. H. Neumann |  |  |
|  | F. Wolf |  |  |

## SUPPORTING INSTITUTIONS

UNIVERSITY OF ARIZONA
UNIVERSITY OF BRITISH COLUMBIA
CALIFORNIA INSTITUTE OF TECHNOLOGY
UNIVERSITY OF CALIFORNIA
MONTANA STATE UNIVERSITY
UNIVERSITY OF NEVADA, RENO
NEW MEXICO STATE UNIVERSITY
OREGON STATE UNIVERSITY

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

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.


#### Abstract

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. Please do not use built up fractions in the text of the manuscript. However, you may use them in the displayed equations. Underline Greek letters in red, German in green, and script in blue. The first paragraph must be capable of being used separately as a synopsis of the entire paper. In particular it should contain no bibliographic references. Please propose a heading for the odd numbered pages of less than 35 characters. Manuscripts, in triplicate, may be sent to any one of the editors. Please classify according to the scheme of Math. Reviews, Index to Vol. 39. Supply name and address of author to whom proofs should be sent. All other communications should be addressed to the managing editor, or Elaine Barth, University of California, Los Angeles, California 90024.

There are page-charges associated with articles appearing in the Pacific Journal of Mathematics. These charges are expected to be paid by the author's University, Government Agency or Company. If the author or authors do not have access to such Institutional support these charges are waived. Single authors will receive 50 free reprints; joint authors will receive a total of 100 free reprints. 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: $\$ 190.00$ a year ( 5 Vols., 10 issues). Special rate: $\$ 95.00$ a year to individual members of supporting institutions.

Subscriptions, orders for numbers issued in the last three calendar years, and changes of address should be sent to Pacific Journal of Mathematics, P.O. Box 969, Carmel Valley, CA 93924, U.S.A. Old back numbers obtainable from Kraus Periodicals Co., Route 100, Millwood, NY 10546.

[^0]
# PUBLISHED BY PACIFIC JOURNAL OF MATHEMATICS, A NON-PROFIT CORPORATION <br> Copyright © 1986 by Pacific Journal of Mathematics 


[^0]:    The Pacific Journal of Mathematics at P.O. Box 969, Carmel Valley, CA 93924 (ISSN 0030-8730) publishes 5 volumes per year. Application to mail at Second-class postage rates is pending at Carmel Valley, California, and additional mailing offices. Postmaster: Send address changes to Pacific Journal of Mathematics, P.O. Box 969, Carmel Valley, CA 93924.

