Proceedings of the American Mathematical Society

This journal is devoted entirely to research in pure and applied mathematics.

Editorial Policy

1. On January 22, 1975, the Council of the American Mathematical Society voted:

   “To be published in the Proceedings, a paper must be correct, new, nontrivial and significant. Further, it must be well written and of interest to a substantial number of mathematicians. Piecemeal results, such as an inconclusive step toward an unproved major theorem or a minor variation on a known result, are in general not acceptable for publication. Proceedings Editors shall solicit, and encourage publication of, worthy papers of length not exceeding 11 typed pages.

   “Very short notes not to exceed two printed pages 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.”

2. On January 23, 1979, the Council of the American Mathematical Society abolished blind refereeing as a policy for the Proceedings, but decided that any author who so requests and who provides a blind copy of a manuscript will have the manuscript refereed blind.

   Two copies of a manuscript should be submitted. If blind refereeing is intended, one should be complete and one blind, and then the latter will be sent to the referee without disclosure of the author’s name or institution.

SUBSCRIPTION INFORMATION. PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY is published monthly. Subscription prices for Volumes 84–86 (1982) are $190.00 list; $95.00 member. Combination paper and microform (microfiche or microfilm) subscription prices are $254.00 list; $127.00 member. Microfiche of each issue will be mailed the fastest way before the camera copy is sent to the printer.

BACK NUMBER INFORMATION. Back number prices per volume are for Volumes 1–77, $52.00 list, $39.00 member; for Volumes 78–83, $84.00 list, $63.00 member. Beginning with Volume 68, back volumes are available in microfiche or microfilm only. The microfilm may be mounted on spools or in Kodak or 3M cartridges. Only current subscribers are eligible to purchase back volumes on microform. Write to the AMS for a detailed price list.

Subscriptions and orders for publications of the American Mathematical Society should be addressed to American Mathematical Society, P. O. Box 1571, Annex Station, Providence, R. I. 02901. All orders must be accompanied by payment. Other correspondence should be addressed to P. O. Box 6248, Providence, R. I. 02940.

PROCEEDINGS of the American Mathematical Society is published monthly by the American Mathematical Society at 201 Charles Street, Providence, R. I. 02904. Second-class postage is paid at Providence, Rhode Island, and additional mailing offices. Postmaster: Send address changes to PROCEEDINGS, American Mathematical Society, P. O. Box 6248, Providence, R. I. 02940

Copyright © 1982 American Mathematical Society
Printed in the United States of America
INDEX TO VOLUME 84

“Starred items are Shorter Notes”

Albertson, Michael O. and Stromquist, Walter R.  *Locally planar toroidal graphs are 5-colorable*, 449.

Altin, Abdullah and Young, Eutiquio C.  *Decomposition formulas for a class of partial differential equations*, 543.

Anandam, Victor.  *Subharmonic functions outside a compact set in $\mathbb{R}^n$*, 52.

Arikan, Nilgün.  *A simple condition ensuring the Arens regularity of bilinear mappings*, 525.

Armstrong, M. A.  *Calculating the fundamental group of an orbit space*, 267.

Bates, Peter W.  *Reduction theorems for a class of semilinear equations at resonance*, 73.

Beaver, Bradley, Sario, Leo and Wang, Cecilia.  *Spherical harmonics generating bounded biharmonics*, 485.

Bhatt, Subhash J.  *On Jordan representations of unbounded operator algebras*, 393.

Bojanov, B. D.  *Proof of a conjecture of Erdős about the longest polynomial*, 99.


Brown, Morton.  See Brechner, Beverly.

Burry, David W. and Carlson, Jon F.  *Restrictions of modules to local subgroups*, 181.


Carlson, Jon F.  See Burry, David W.

Cater, F. S.  *When total variation is additive*, 504.

Chan, K. Y., Chen, Y. M., Liu, M. C. and Ng, S. M.  *An example on strong unicity constants in trigonometric approximation*, 79.


Chatterjee, S.  See Yadav, B. S.

Chen, Y. M.  See Chan, K. Y.

Choda, Marie.  *Characterization of approximately inner automorphisms*, 231.

Colvin, Michael and Morrison, Kent.  *A symplectic fixed point theorem on open manifolds*, 601.

Courter, R. C.  *Finite dimensional right duo algebras are duo*, 157.


Cwikel, Michael and Reisner, Shlomo.  *Interpolation of uniformly convex Banach spaces*, 555.

Dahmen, Wolfgang and Micchelli, Charles A.  *On entire functions of affine lineage*, 344.

Desale, G. B. and Varadarajan, K.  *Extension of a result of Beachy and Blair*, 335.


Ejiri, Norio.  *Totally real minimal immersions of n-dimensional real space forms into n-dimensional complex space forms*, 243.


Ewell, John A.  *Completion of a Gaussian derivation*, 311.

Fay, Temple H., Rajagopalan, M. and Smith-Thomas, Barbara V.  *Embedding the free group $F(X)$ into $F(\beta X)$*, 297.

Feintuch, Avraham.  *Factorization along nest algebras*, 192.

Felzenszwalb, B.  *Derivations in prime rings*, 16.

Feng, Kequin.  *On the first factor of the class number of a cyclotomic field*, 479.

Fong, C. K., Miers, C. R. and Sourour, A. R.  *Lie and Jordan ideals of operators on Hilbert space*, 516.


Fournier, John J. F.  *Two UC-sets whose union is not a UC-set*, 69.

Galloway, Gregory J.  *Compactness criteria for Riemannian manifolds*, 106.

Ganong, R.  *Plane Frobenius sandwiches*, 474.

612 INDEX TO VOLUME 84

Gill, John. Converging factors for continued fractions $K(a_n/1)$, $a_n \to 0$, 85.

Gotay, Mark J. On coisotropic imbeddings of presymplectic manifolds, 111.

Greim, Peter. An extremal vector-valued $L^p$-function taking no extremal vectors as values, 65.

Gulliver, Robert and Morgan, Frank. The symmetry group of a curve preserves a plane, 408.

*Harris, Lawrence A. An inequality for trigonometric polynomials, 155.

Herzog, J. Strict local rings, 165.

Hofmann, Karl H., Liukkonen, John R. and Mislove, Michael W. Compact extensions of compactly generated nilpotent groups are pro-Lie, 443.

Hooghiemstra, G. On the explicit form of the density of Brownian excursion local time, 127.

Jorgensen, Troels. Traces in 2-generator subgroups of $SL(2, \mathbb{C})$, 339.

Jungck, Gerald. The cohesive property, 138.

Kaftal, Victor. Relative weak convergence in semifinite von Neumann algebras, 89.


Katuta, Yûkiti. On the covering dimension of inverse limits, 588.


Khoaravi, A. Derivations on commutative Banach algebras, 60.

Knebusch, Manfred. An algebraic proof of the Borsuk-Ulam theorem for polynomial mappings, 29.

Kochman, Stanley O. Polynomial generators for $H_*(BSU)$ and $H_*(BSO; \mathbb{Z}_2)$, 149.

Koohara, Akira. Pseudoholomorphic functions with nonantiholomorphic characteristics, 217.


Kostreva, Michael M. Finite test sets and P-matrices, 104.

Kumar, Arun. Absolute total-effectiveness of a total effective $(N, p_n)$ method, 497.

Kura, Takeshi. Oscillation theorems for a second order sublinear ordinary differential equation, 535.

Kurková, Věra. Cardinal functions on modifications of uniform spaces and fine uniform spaces, 593.

Kwong, Man Kam. On certain comparison theorems for second order linear oscillation, 539.

Landweber, Peter S. Finite homological dimension of $BP_*(X)$ for infinite complexes, 420.

Lichtenstein, Woody. A system of quadrics describing the orbit of the highest weight vector, 605.

Liu, M. C. See Chan, K. Y.

Liukkonen, John R. See Hofmann, Karl H.

Longstaff, W. E. Subspace maps of operators on Hilbert space, 195.

McAdam, Stephen. Two applications of asymptotic prime divisors, 179.


McCoy, R. A. Completely metrizable spaces of embeddings, 437.

Machado, Armando. A locally closed set with a smooth group structure is a Lie group, 303.

Magid, Martin A. Shape operators of Einstein hypersurfaces in indefinite space forms, 237.

Mead, D. G. and Narkiewicz, W. The capacity of $C_\ast$ and free sets in $C^2_\ast$, 308.

Megibben, Charles. Countable injective modules are sigma injective, 8.


Micchelli, Charles A. See Dahman, Wolfgang.

Miers, C. R. See Fong, C. K.

Miles, Frank B. A characterization of the uniform closure of the set of homeomorphisms of a compact totally disconnected metric space into itself, 264.

van Mill, Jan. Strong local homogeneity does not imply countable dense homogeneity, 143.

Miller, Douglas E. Index sets and Boolean operations, 568.

Miller, Haynes, An algebraic analogue of a conjecture of G. W. Whitehead, 131.

Mniowitz, Ruth. Normal families of quasimeromorphic mappings, 35.

Misercque, Didier. The nonhomogeneity of the E-tree—Answer to a problem raised by D. Jensen and A. Ehrenfeucht, 573.

Mislove, Michael W. See Hofmann, Karl H.

Modica, Luciano, Mortola, Stefano and Salsa, Sandro. A nonvariational second order elliptic operator with singular elliptic measure, 225.

Morgan, Frank. See Gulliver, Robert.
Morrison, Kent. See Colvin, Michael.
Mortola, Stefano. See Modica, Luciano.
Mullen, Gary L. *Polynomials over finite fields which commute with linear permutations*, 315.
Murphy, G. J. *Triangularizable algebras of compact operators*, 354.
Narkiewicz, W. See Mead, D. G.
Nebbia, Claudio. *Multipliers and asymptotic behaviour of the Fourier algebra of nonamenable groups*, 549.
Neumann-Lara, Victor. See Meyer, Paul R.
Ng, S. M. See Chan, K. Y.
Nulton, James D. and Stolarsky, Kenneth B. *The first sign change of a cosine polynomial*, 55.
Ostrowski, B. J. *A negative answer to three questions on K-primitive rings*, 33.
Øyma, Knut and Rookshin, Serge. *Derivatives of \(H^0\) functions*, 97.
Papastavridis, Stavros. *Generators of \(H^*(MSO; \mathbb{Z}_2)\) as a module over the Steenrod algebra, and the oriented cobordism ring*, 285.
———. See Charitos, Leonidas.
Passty, Gregory B. *Construction of fixed points for asymptotically nonexpansive mappings*, 212.
Paulowich, D. G. *Trees are contractible*, 429.
Pearce, Kent. *A product theorem for \(\mathcal{L}_p\) classes and an application*, 509.
Rajagopalan, M. See Fay, Temple H.
Reisner, Shlomo. See Cwikel, Michael.
Rookshin, Serge. See Øyma, Knut.
Rowen, Louis H. and Saltman, David J. *Dihedral algebras are cyclic*, 162.
Saab, Elias and Saab, Paulette. *A stability property of a class of Banach spaces not containing a complemented copy of \(l_1\)*, 44.
Saab, Paulette. See Saab, Elias.
Salsa, Sandro. See Modica, Luciano.
Saltman, David J. See Rowen, Louis H.
Sario, Leo. See Beaver, Bradley.
Sarraillé, J. J. *Noetherian \(PI\) rings not module-finite over any commutative subring*, 457.
Schechtman, Gideon. *On commuting families of nonexpansive operators*, 373.
Schiff, J. L. *A uniqueness theorem for superharmonic functions in \(R^3\)*, 362.
Seese, Detlef, Tuschik, Peter and Weese, Martin. *Undecidable theories in stationary logic*, 563.
Seifert, George. *Almost periodic solutions for a certain class of almost periodic systems*, 47.
Shore, Richard A. *Finitely generated codings and the degrees r.e. in a degree \(d\)*, 256.
Sibley, Thomas Q. *Ultrafilter limits and finitely additive probability*, 560.
Smith-Thomas, Barbara V. See Fay, Temple H.
Sourour, A. R. See Fong, C. K.
Stallings, John R. *Topologically unrealizable automorphisms of free groups*, 21.
Stepp, J. W. See Brown, D. R.
Steprōns, Juris. *Cardinal arithmetic and \(K_1\)-Borel sets*, 121.
Stolarsky, Kenneth B. See Nulton, James D.
Stong, R. E. *Splitting universal bundles over flag manifolds*, 576.
Stromquist, Walter R. See Albertson, Michael O.
Sukla, Indulata. *A Tauberian theorem for strong Abel summability type*, 185.
Sunder, V. S. *Distance between normal operators*, 483.
Svensen, E. C. *Unitary one-parameter groups with finite speed of propagation*, 357.
Szafaniec, F. H. *Subnormals in \(C^*\)-algebras*, 533.
Takeuchi, Mitsuhiro. *A simple proof of the extension theorem of sequences of divided powers in characteristic \(p\)*, 175.
Tamura, Takayuki. *Free \(E\)-m groups and free \(E\)-m semigroups*, 318.


Tuschik, Peter. See Seese, Detlef.

Varadarajan, K. See Desale, G. B.

Vinsonhaler, C. and Wickless, W. J. *The cotypeset of a torsion free abelian group of rank two*, 467.


Wang, Cecilia. See Beaver, Bradley.

Wang, S. P. *On anisotropic solvable linear algebraic groups*, 11.

Weese, Martin. See Seese, Detlef.

Wickless, W. J. See Vinsonhaler, C.

Wickstead, Anthony W. *Spectral properties of compact lattice homomorphisms*, 347.

Wilson, Richard G. See Meyer, Paul R.


Wong, James C. S. *On left thickness of subsets in semigroups*, 403.

Würfel, Tilmann. *On the divisible part of the Brauer group of a field*, 173.

Yadav, B. S. and Chatterjee, S. *On a characterization of invariant subspace lattices of weighted shifts*, 492.

Yeh, Chih-Chih. *Oscillation theorems for nonlinear second order differential equations with damped term*, 397.


Yoneda, Kaoru. See Wade, William R.


Young, Eutiquio C. See Altin, Abdullah.
Manuscript Information

1. Articles submitted for publication should be typewritten, double spaced, and no more than 11 (8 1/2" × 11") pages long. 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. Authors must keep complete copies of their manuscripts, and editors will acknowledge receipt.

2. 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. 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 1980 Mathematics Subject Classification 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 1980 Mathematics Subject Classification with instructions for its use can be found in the 1978 Subject Index to Mathematical Reviews.

3. A Copyright Transfer Agreement is required before a paper will be published in the Proceedings. A copy of the form is sent with the acknowledgement of receipt of manuscript from the Providence office of the Society. Authors are urged to return the forms immediately to prevent delays in processing and publishing of the manuscript.

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 02940.

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.

PUBLICATION CHARGES. The research journals of the American Mathematical Society carry a page charge of $50.00 per page to help defray the cost of publication. This amount is charged to the institution or to a contract supporting the research reported in the published paper. The publication charge policy of the United States Federal Council for Science and Technology (FCST) is reported on page 112 of the February, 1975 issue of the NOTICES of the American Mathematical Society. In no case is the author personally responsible for paying the page charge, nor is acceptance of the author's paper for publication dependent upon payment of the page charge.

BACKLOG. 100 pages. Papers currently being received by the editors will be published in 10–12 months.

COPYING AND REPRINTING. Individual readers of this publication, and nonprofit libraries acting for them are permitted to make fair use of the material, such as to copy an article for use in teaching or research. Permission is granted to quote brief passages from this publication in reviews provided the customary acknowledgement of the source is given.

Republication, systematic copying, or multiple reproduction of any material in this publication (including abstracts) is permitted only under license from the American Mathematical Society. Requests for such permission should be addressed to the Executive Director, American Mathematical Society, Box 6248, Providence, Rhode Island 02940.

The appearance of the code on the first page of an article in this journal indicates the copyright owner's consent for copying beyond that permitted by Sections 107 or 108 of the U. S. Copyright Law, provided that the copier pay the stated per copy fee through the Copyright Clearance Center, Inc., 21 Congress Street, Salem, Massachusetts 01970. This consent does not extend to other kinds of copying, such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale.
Submission of Manuscript

Send papers directly to one of the editors listed under the subject field of the paper. The numbers in parentheses are the first two digits of major classifications from the 1980 Mathematics Subject Classification and describe the fields being handled by the editor.

LOGIC AND FOUNDATIONS (03 04)
Thomas J. Jech, Department of Mathematics, Pennsylvania State University, University Park, Pennsylvania 16802

COMBINATORICS AND DISCRETE MATHEMATICS (05 15)
Thomas H. Brylawski, Department of Mathematics, University of North Carolina, Chapel Hill, North Carolina 27514

COMMUTATIVE ALGEBRA (06 12 13 14 15 18)
William C. Waterhouse, Department of Mathematics, Pennsylvania State University, University Park, Pennsylvania 16802

GENERAL ALGEBRA (16 17 18 08)
Donald Passman, Department of Mathematics, University of Wisconsin, Madison, Wisconsin 53706

GROUP THEORY (20)
David M. Goldschmidt, Department of Mathematics, University of California at Berkeley, Berkeley, California 94720

ALGEBRAIC AND DIFFERENTIAL TOPOLOGY (55 57 58)
Reinhard E. Schultz, Department of Mathematics, Purdue University, West Lafayette, Indiana 47907

REAL VARIABLES (26 28 40)
J. Jerry Uhl, Jr., Department of Mathematics, University of Illinois, Urbana, Illinois 61801

COMPLEX VARIABLES AND NUMBER THEORY (10 30 31 32)
W. E. Kirwan, Department of Mathematics, University of Maryland, College Park, Maryland 20742
Lawrence A. Zalcman, Department of Mathematics, University of Maryland, College Park, Maryland 20742

DIFFERENTIAL EQUATIONS AND DYNAMICAL SYSTEMS (33 34 35 39 49 58)
George R. Sell, School of Mathematics, University of Minnesota, Minneapolis, Minnesota 55455

GENERAL ANALYSIS (41 42 43 44 45)
Richard R. Goldberg, Department of Mathematics, Vanderbilt University, Nashville, Tennessee 37235

FUNCTIONAL ANALYSIS AND OPERATOR THEORY (46 47)
Catherine L. Olsen, Department of Mathematics, State University of New York at Buffalo, Buffalo, New York 14214

FUNCTIONAL ANALYSIS AND CONVEXITY (46 52)
Robert R. Phelps, Department of Mathematics GN-50, University of Washington, Seattle, Washington 98195

COMPLEX VARIABLES, FUNCTIONAL ANALYSIS AND OPERATOR THEORY (30 46 47)
Donald E. Sarason, Department of Mathematics, University of California at Berkeley, Berkeley, California 94720

LIE GROUPS AND GEOMETRY (22 51 53)
Jeff Cheeger, Department of Mathematics, State University of New York at Stony Brook, Stony Brook, New York 11794

GENERAL TOPOLOGY (54)
David J. Lutzer, Department of Mathematics, Texas Tech University, Lubbock, Texas 79409
Doug W. Curtis, Department of Mathematics, Louisiana State University, Baton Rouge, Louisiana 70803

PROBABILITY AND OTHER FIELDS (60–99 inclusive)
Thomas G. Kurtz, Department of Mathematics, University of Wisconsin, Madison, Wisconsin 53706.

All other communications should be addressed to the Managing Editor, Richard R. Goldberg, at the above address.

ABCD EFGHIJ–EB–898765432
CONTENTS

Vol. 84, No. 4 April 1982 Whole No. 274

A. ALGEBRA AND NUMBER THEORY

Noetherian PI rings not module-finite over any commutative subring. By J. J. SARRAILLÉ 457
Some remarks on the Hasse norm theorem. By HANS OPOLKA 464
The cotypeset of a torsion free abelian group of rank two. By C. VINSONHALER and W. J. WICKLESS 466
Plane Frobenius sandwiches. By R. GANONG 470
On the first factor of the class number of a cyclotomic field. By KEQIN FENG 479
Distance between normal operators. By V. S. SUNDER 483

B. ANALYSIS

Spherical harmonics generating bounded biharmonics. By BRADLEY BEAVER, LEO SARIO and CECILIA WANG 485
On a characterization of invariant subspace lattices of weighted shifts. By B. S. YADAV and S. CHATTERJEE 492
Absolute total-effectiveness of a total effective (N, P) method. By ARUN KUMAR 497
When total variation is additive. By F. S. CATER 504
A product theorem for \mathcal{F}_P classes and an application. By KENT PEARCE 509
Lie and Jordan ideals of operators on Hilbert space. By C. K. FONG, C. R. MIERS and A. R. SOUROUR 516
Renorming dual Banach lattices. By N. GHOUSSOUB 521
A simple condition ensuring the Arens regularity of bilinear mappings. By F. H. SZAFRANIEC 533
Oscillation theorems for a second order sublinear ordinary differential equation. By TAKEISHI KURA 535
On certain comparison theorems for second order linear oscillation. By MAN KAM KWONG 539
Decomposition formulas for a class of partial differential equations. By ABDULLAH ALTIN and EUTIQUIO C. YOUNG 543
Multipliers and asymptotic behaviour of the Fourier algebra of nonamenable groups. By CLAUDIO NEBBIA 549
Interpolation of uniformly convex Banach spaces. By MICHAEL CWIKEI and SHLOMO REISNER 555

E. LOGIC AND FOUNDATIONS

Ultrafilter limits and finitely additive probability. By THOMAS Q. SIBLEY 560
Undecidable theories in stationary logic. By DETLEF SEESE, PETER TUSCHIK and MARTIN WEESER 563
Index sets and Boolean operations. By DOUGLAS E. MILLER 568
The nonhomogeneity of the E-tree—Answer to a problem raised by D. Jensen and A. Ehrenfeucht. By DIDIER MISERICQUE 573

G. TOPOLOGY

Splitting universal bundles over flag manifolds. By R. E. STONG 576
Inner points and breadth in certain compact semilattices. By D. R. BROWN and J. W. STEPP 581
On the covering dimension of inverse limits. By YÜKTI KATUTA 588
Cardinal functions on modifications of uniform spaces and fine uniform spaces. By VĚRA KŮRKOVÁ 593
A symplectic fixed point theorem on open manifolds. By MICHAEL COLVIN and KENT MORRISON 601
A system of quadrics describing the orbit of the highest weight vector. By WOODY LICHTENSTEIN 605
A duality principle. By WOLFGANG SANDER 609
Index to Volume 84 611