

PROCEEDINGS
OF THE
AMERICAN MATHEMATICAL SOCIETY

EDITED BY

FRED G. BRAUER	ARTHUR MATTUCK
W. H. J. FUCHS	ERNEST A. MICHAEL
IRVING GLICKSBERG	IRVING REINER
P. EMERY THOMAS	

WITH THE COÖPERATION OF

W. W. BOONE	S. M. SHAH
JOSHUA CHOVER	HANS WEINBERGER

VOLUME 22, NUMBER 3
SEPTEMBER, 1969

PUBLISHED BY THE AMERICAN MATHEMATICAL SOCIETY
PROVIDENCE, RHODE ISLAND

Proceedings of the American Mathematical Society

The PROCEEDINGS of the American Mathematical Society is devoted entirely to research in pure and applied mathematics, and the publication of original papers of moderate length. Articles for insertion should be typewritten and double spaced. Ditto is not generally satisfactory, although other modes of multiple reproduction may be. 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.) 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.

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.). It should be at least one complete sentence, but not over 150 words, with the upper limit primarily for longer papers. The title should be short, but informative; useless or vague phrases such as "some remarks about" or "concerning" should be avoided. At the end of the article, placed before the first footnote, there should be first the A.M.S. *subject classification numbers* representing the primary and secondary subjects of the article, followed by a list of *key words* and *phrases* describing the subject matter of the article and taken from it. A list of subject classification numbers is printed at the end of each volume of Mathematical Reviews. See the June 1969 Notices for more details, as well as illustrative examples.

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 of 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.)

Papers in algebra and number theory should be sent to ARTHUR MATTUCK, Room 2-275, Mathematics Department, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, or to IRVING REINER, Mathematics Department, University of Illinois, Urbana, Illinois 61801.

Papers in modern or classical analysis should be sent to IRVING GLICKSBERG, Mathematics Department, University of Washington, Seattle, Washington 98105, or to W. H. J. FUCHS, White Hall, Cornell University, Ithaca, New York 14850.

Papers in algebraic geometry should be sent to ARTHUR MATTUCK; papers in set-theoretic and general topology to ERNEST MICHAEL, Mathematics Department, University of Washington, Seattle, Washington 98105; in algebraic topology and all other types of geometry to P. EMERY THOMAS, Mathematics Department, University of California, Berkeley, California 94720.

Papers in applied mathematics, differential equations, and related areas of analysis should be sent to FRED BRAUER, Mathematics Department, University of Wisconsin, Madison, Wisconsin 53706.

Papers in probability, statistics, and related fields should be sent to JOSHUA CHOVER, Mathematics Department, University of Wisconsin, Madison, Wisconsin 53706.

Papers in logic, set theory, and related areas should be sent to W. W. BOONE, Mathematics Department, University of Illinois, Urbana, Illinois 61801.

All other communications should be addressed to the Managing Editor, ARTHUR MATTUCK, at the above address.

Inquiries from authors regarding reprints, or changes of addresses for mailing proofs, should be sent directly to the Editorial Department, American Mathematical Society, P. O. Box 6248, Providence, Rhode Island 02904.

Four volumes of three issues are planned for 1969. The subscription price is \$80.00 for the four volumes. Back issues of Volumes 1-16 are available at a price of \$14.00 each and Volumes 17-21 at a price of \$18.00 each.

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, 321 S. Main St., P. O. Box 6248, Providence, R. I. 02904. Second-class postage paid at Providence, Rhode Island and additional mailing offices.

Copyright ©, American Mathematical Society, 1969
Printed in the United States of America

INDEX TO VOLUME 22

* Starred items are "Shorter Notes"

- Aberth, Oliver. *A chain of inclusion relations in computable analysis*, 539.
- Adler, Andrew. *Some recursively unsolvable problems in analysis*, 523.
- Agrawal, B. D. and Khanna, I. K. *A general differential equation for classical polynomials*, 646.
- Alder, Henry L. *Proof of Andrews' conjecture on partition identities*, 688.
- Allan, G. R. *A note on the holomorphic functional calculus in a Banach algebra*, 77.
- * Andrews, George E. *On Ramanujan's summation of ${}_1\psi_1(a; b; z)$* , 552.
- Antonelli, P. L. *Montgomery-Samelson singular fiberings of spheres*, 247.
- Arsove, Maynard G. *A correction to "Some boundary properties of the Riemann mapping function,"* 711.
- Bacon, Philip. *Compact means in the plane*, 242.
- Bagley, R. W. and Weddington, D. D. *Products of k' -spaces*, 392.
- Baker, James D. See Wright, Fred M.
- Barth, K. F. and Schneider, W. J. *An asymptotic analog of the F. and M. Riesz radial uniqueness theorem*, 53.
- Basmaji, B. G. *On the isomorphisms of two metacyclic groups*, 175.
- Beaumont, Ross A. *A note on products of homogeneous torsion free abelian groups*, 434.
- Berndt, Bruce C. *On the zeros of the Riemann zeta-function*, 183.
- Bernhardt, Robert L. *Splitting hereditary torsion theories over semiperfect rings*, 681.
- Bernstein, Herbert J. *CCN-groups of order divisible by three primes*, 202.
- Billis, M. *A note on a theorem of B. H. Neumann and S. Yamamuro*, 439.
- Bogart, Kenneth P. *Idempotent Noether lattices*, 127.
- . *Nonimbeddable Noether lattices*, 129.
- Bogdanowicz, Witold M. *Analytic continuation of holomorphic functions with values in a locally convex space*, 660.
- Brand, Louis. *On the product of singular symmetric matrices*, 377.
- Brown, Edward M. *A note on punctured disks in a 2-manifold*, 471.
- Brown, H. I., Kerr, D. R. and Stratton, H. H. *The structure of $B[c]$ and extensions of the concept of conull matrix*, 7.
- Brown, Terrence J. *A recursion formula for finite partition lattices*, 124.
- Bryan, Robert Neff. *A nonhomogeneous linear differential system with interface conditions*, 270.
- Burgess, C. E. and Cannon, J. W. *Tame subsets of spheres in E^3* , 395.
- Cannon, J. W. See Burgess, C. E.
- Chacon, R. V. *Weakly mixing transformations which are not strongly mixing*, 559.
- Cima, Joseph A. *On the dual of Hornick's space*, 102.
- Conlon, Lawrence. *Remarks on commuting involutions*, 255.
- Connors, Edward A. *The structure of O'/Ω over local fields of characteristic two*, 596.
- Cox, S. H., Jr. *Determinantal rank and flat modules*, 104.
- Crabtree, Douglas E. and Haynsworth, Emilie V. *An identity for the Schur complement of a matrix*, 364.
- Curtis, M. L. and Dugunji, J. *Groups which are cogroups*, 235.
- Cutler, Doyle O. and Winthrop, Joel. *A note on a paper of Paul Hill and Charles Megibben*, 428.
- Das, K. M. *An inequality similar to Opial's inequality*, 258.
- Davis, William J. *Basis preserving maps*, 34.

- Dikshit, H. P. *Absolute summability of a series associated with a Fourier series*, 316.
- Ditzian, Z. *On Hille's first exponential formula*, 351.
- Dugundji, J. See Curtis, M. L.
- Duren, P. L. *On the multipliers of H^p spaces*, 24.
- Dyer, James A. See Johnson, William B.
- Eaton, W. T. *Taming a surface by piercing with disks*, 724.
- Einhorn, Sheldon J. *Functions positive definite in $C[0, 1]$* , 702.
- Evyatar, A. and Zaks, A. *Purely transcendental subfields of $k(x_1, \dots, x_n)$* , 582.
- Faudree, R. J. *Locally finite and solvable subgroups of sfields*, 407.
- Fernholz, E. R. *Bounds for holomorphic vector fields*, 344.
- Figà-Talamanca, Alessandro. *Bounded and continuous random Fourier series on non-commutative groups*, 573.
- Foguel, S. R. *Positive operators on $C(X)$* , 295.
- Fort, Tomlinson. *The nonhomogeneous linear difference equation with variable difference interval*, 262.
- Gilfeather, Frank. *Asymptotic convergence of operators in Hilbert space*, 69.
- Gilmer, Robert. *A note on generating sets for invertible ideals*, 426.
- Gitler, S., Mahowald, M. and Milgram, R. James. *Secondary cohomology operations and complex vector bundles*, 223.
- Goldstein, Jerome A. *Some remarks on infinitesimal generators of analytic semigroups*, 91.
- * Goto, Morikuni. *Products of two one-parameter subgroups*, 554.
- Gupta, N. D. *The free metabelian group of exponent p^2* , 375.
- Gutierrez-Novoa-Lino. *Independence of a certain axiomatic system*, 470.
- Hager, Anthony W. *Approximation of real continuous functions on Lindelöf spaces*, 156.
- Hallam, Thomas G. *An asymptotic expansion for a nonhomogeneous linear system*, 489.
- Hansen, Wolfhard and Klee, Victor. *Intersection theorems for positive sets*, 450.
- Harrell, C. E. *Riesz matrices that are also Hausdorff matrices*, 303.
- Haynsworth, Emilie V. See Crabtree, Douglas E.
- Hedlund, James H. *Multipliers of H^1 and Hankel matrices*, 20.
- Heidel, J. W. *A nonoscillation theorem for a nonlinear second order differential equation*, 485.
- Heinzer, William. *On Krull overrings of a noetherian domain*, 217.
- Hentzel, Irvin Roy. *$(-1, 1)$ rings*, 367.
- Herod, J. V. *Multiplicative inverses of solutions for Volterra-Stieltjes integral equations*, 650.
- Herzog, Marcel. *On centralizers of involutions*, 170.
- Hill, Paul. *On transitive and fully transitive primary groups*, 414.
- Hochstadt, Harry. *On an inequality of Lyapunov*, 282.
- Hummel, J. A. *The coefficients of starlike functions*, 311.
- Jenkins, James A. *A uniqueness result on conformal mapping*, 324.
- Jerome, J. W. and Schumaker, L. L. *Applications of ϵ -entropy to the computation of n -widths*, 719.
- Johnson, Roy A. *Some types of Borel measures*, 94.
- Johnson, William B. and Dyer, James A. *Isomorphisms generated by fundamental and total sets*, 330.
- Kalmbach, Gudrun. *On smooth bounded manifolds*, 466.
- Karrass, A. and Solitar, D. *On finitely generated subgroups of a free group*, 209.
- Kauffman, Robert M. *Completely continuous inverses of ordinary differential operators*, 657.

- Kent, C. F. *Reducing ordinal recursion*, 690.
- Kerr, D. R. See Brown, H. I.
- Khanna, I. K. See Agrawal, B. D.
- Kiernan, Peter. *Hyperbolic submanifolds of complex projective space*, 603.
- Klee, Victor. See Hansen, Wolfhard.
- Kleinfeld, Erwin and Kleinfeld, Margaret Humm. *A nonidentity for right alternative rings*, 109.
- Kleinfeld, Margaret Humm. See Kleinfeld, Erwin.
- König, Heinz. *On the Gleason and Harnack metrics for uniform algebras*, 100.
- Kraines, David. *Rational cohomology operations and Massey products*, 238.
- Kreith, Kurt. *Sturmian theorems for hyperbolic equations*, 279.
- Ku, Hsu-Tung. *A note on semifree actions of S^1 on homotopy spheres*, 614.
- Ku, Hsu-Tung and Ku, Mei-Chin. *A note on the index of a G -manifold*, 600.
- Ku, Mei-Chin. See Ku, Hsu-Tung.
- Kugler, Lawrence D. *Nonstandard almost periodic functions on a group*, 527.
- Larsen, Max D. *Harrison primes in a ring with few zero divisors*, 111.
- Lavine, Richard B. *Absolute continuity of Hamiltonian operators with repulsive potential*, 55.
- Layman, J. W. *Expansion of analytic functions in exponential polynomials*, 519.
- Leadbetter, M. R. and Weissner, Edward W. *On continuity and other analytic properties of stochastic process sample functions*, 291.
- Leitzel, James R. C. *Galois cohomology and class number in constant extension of algebraic function fields*, 206.
- Lemire, F. W. *Weight spaces and irreducible representations of simple Lie algebras*, 192.
- Letac, Gérard. *A note about Wiener-Hopf sets*, 298.
- Lewis, P. W. *Extension of operator valued set functions with finite semivariation*, 563.
- Liu, Chen Tung. *The α -closure αX of a topological space X* , 620.
- Loeb, Peter A. *Compactifications of Hausdorff spaces*, 627.
- * Lutzer, David J. *A metrization theorem for linearly orderable spaces*, 557.
- McMillan, D. R., Jr. and Row, Harry. *Tangled embeddings of one-dimensional continua*, 378.
- Mahowald, M. See Gitler, S.
- Mann, Avinoam. *On subgroups of finite solvable groups*, 214.
- Marden, Morris. *On composite abstract homogeneous polynomials*, 28.
- Marx, Morris L. *The Gauss realizability problem*, 610.
- Mayes, Vivienne. *Some steady state properties of $(\int_0^x f(t)dt)/f(x)$* , 672.
- Menon, K. V. *An inequality of Schur and an inequality of Newton*, 441.
- Milgram, R. James. See Gitler, S.
- Minc, Henryk. *On lower bounds for permanents of $(0, 1)$ matrices*, 117.
- Mordeson, J. N. and Vinograd, B. *Note on relative p -bases of purely inseparable extensions*, 587.
- Mozzochi, C. J. *On a Riemann sum construction of Rudin*, 718.
- Niven, Ivan. *Averages of exponents in factoring integers*, 356.
- Ornstein, Donald. *On a theorem of Orey*, 549.
- * Passman, D. S. *Central idempotents in group rings*, 555.
- Paterson, Alan L. T. *Isometries between B^* -algebras*, 570.
- Pettis, B. J. *Cluster sets of nets*, 386.
- Pfaltz, John L. *Semihomomorphisms of semimodular lattices*, 418.
- Pincus, Joel D. and Rovnyak, James. *A representation theorem for determining functions*, 498.

- Pinsky, Mark. *An elementary derivation of Khintchine's estimate for large deviations*, 288.
- Pothoven, Kenneth. *Projective and injective objects in the category of Banach spaces*, 437.
- Proctor, T. G. *Characteristic multipliers for some periodic differential equations*, 503.
- Pugh, Walter. *Sums of functions of bounded index*, 319.
- Rainwater, John. *Local uniform convexity of Day's norm on $c_0(\Gamma)$* , 335.
- Ratti, J. S. *Correction to "On strong Riesz summability factors of infinite series,"* 723.
- Robinson, Julia. *Unsolvable diophantine problems*, 534.
- Rosenthal, Aaron. *Riemannian manifolds of constant k -nullity*, 473.
- Rovnyak, James. See Pincus, Joel D.
- Row, Harry. See McMillan, D. R., Jr.
- Rupp, Russell D., Jr. *Uniqueness for second order linear parabolic operators*, 285.
- * Samelson, Hans. *Orientability of hypersurfaces in R^n* , 301.
- Santos, Eugene S. *Probabilistic Turing machines and computability*, 704.
- Schenkman, Eugene. *The tower theorem for finite groups*, 458.
- Schneider, W. J. See Barth, K. F.
- Schubert, C. F. *Invariant subspaces with invariant complements*, 85.
- Schumaker, L. L. See Jerome, J. W.
- Schwabauer, Robert. *Commutative semigroup laws*, 591.
- Schwabhäuser, Wolfram. *The connection between two geometrical axioms of H. N. Gupta*, 233.
- Schwartz, Alan L. *An inversion theorem for Hankel transforms*, 713.
- Shatz, Stephen S. *Principal homogeneous spaces for finite group schemes*, 678.
- Shawyer, B. L. R. *On the relation between the Abel and Borel-type methods of summability*, 15.
- Shub, Michael and Williams, R. F. *Future stability is not generic*, 483.
- Skwarczynski, M. *The invariant distance in the theory of pseudoconformal transformations and the Lu Qi-Keng conjecture*, 305.
- Smith, James C., Jr. *Lebesgue characterizations of uniformity-dimension functions*, 164.
- Solitar, D. See Karrass, A.
- Spatz, I. N. *Smooth Banach algebras*, 328.
- Stephenson, R. M., Jr. *A countable minimal Urysohn space is compact*, 625.
- Stepp, James W. *D-semigroups*, 402.
- Stratton, H. H. See Brown, H. I.
- Strauss, Aaron and Yorke, James A. *Identifying perturbations which preserve asymptotic stability*, 513.
- Stoll, Wilhelm. *About the universal covering of the complement of a complete quadrilateral*, 326.
- Suffridge, Ted J. *On the kernel function for the intersection of two simply connected domains*, 37.
- Suzuki, Noboru. *The structure of spectral operators with completely continuous imaginary part*, 82.
- . *On the irreducibility of weighted shifts*, 579.
- . *On a weakly convergent sequence of normal functionals on a von Neumann algebra*, 697.
- Terkelsen, Frode. *On semigroups of operators in locally convex spaces*, 340.
- Thomas, C. B. *On periodic maps which respect a symplectic structure*, 251.
- Tindell, Ralph. *Extending homeomorphisms of $S^p \times S^q$* , 230.
- Tondra, Richard J. *Characterization of connected 2-manifolds without boundary which have finite domain rank*, 479.

- Tonne, P. C. *On the convergence of Bernstein polynomials for some unbounded analytic functions*, 1.
- Trotter, H. F. *On the norms of units in quadratic fields*, 198.
- Tsagas, Grigorios. *A relation between killing tensor fields and negative pinched Riemannian manifolds*, 476.
- Tzafriri, L. *Reflexivity of cyclic Banach spaces*, 61.
- * Ulrich, Dolph. *Solution to a problem posed by Kalicki*, 728.
- Varadarajan, K. *A note on topological parallelizability*, 607.
- Vasconcelos, Wolmer V. *On projective modules of finite rank*, 430.
- Vidossich, Giovanni. *A remark on the density character of function spaces*, 618.
- Vinograd, B. See Mordeson, J. N.
- Warfield, R. B., Jr. *A Krull-Schmidt theorem for infinite sums of modules*, 460.
- Warner, Kenneth K. *The spectrum of a linear operator under perturbation by certain compact operators*, 667.
- Weddington, D. D. *On k -spaces*, 635.
- . See Bagley, R. W.
- Weissner, Edward W. See Leadbetter, M. R.
- Wicke, H. H. *On the Hausdorff open continuous images of Hausdorff paracompact p -spaces*, 136.
- Williams, R. F. See Shub, Michael.
- Williams, Richard K. *A note on expansive mappings*, 145.
- Willmott, R. C. *On the uniformization of Souslin \mathfrak{F} sets*, 148.
- Winthrop, Joel. See Cutler, Doyle O.
- Witthoft, William G. *A class of flexible nilstable algebras*, 361.
- Wright, Fred M. and Baker, James D. *On integration-by-parts for weighted integrals*, 42.
- Yang, Jaw-ching. *A theorem on the semigroup of binary relations*, 134.
- Yohe, Cleon R. *Commutative rings whose matrix rings are Baer rings*, 189.
- Yohe, J. M. *Monotone mapping properties of hereditarily infinite dimensional spaces*, 639.
- Yorke, James A. *Periods of periodic solutions and the Lipschitz constant*, 509.
- . See Strauss, Aaron.
- Zaks, A. See Evyatar, A.
- Zame, Alan. *A note on Wallman spaces*, 141.

Contents—Continued from back cover

Splitting hereditary torsion theories over semiperfect rings. By ROBERT L. BERNHARDT.....	681
Proof of Andrews' conjecture on partition identities. By HENRY L. ALDER.....	688
Reducing ordinal recursion. By C. F. KENT.....	690
On a weakly convergent sequence of normal functionals on a von Neumann algebra. By NOBORU SUZUKI.....	697
Functions positive definite in $C[0, 1]$. By SHELDON J. EINHORN.....	702
Probabilistic Turing machines and computability. By EUGENE S. SANTOS.....	704
A correction to "Some boundary properties of the Riemann mapping function." By MAYNARD G. ARSOVE.....	711
An inversion theorem for Hankel transforms. By ALAN L. SCHWARTZ...	713
On a Riemann sum construction of Rudin. By C. J. MOZZOCHI.....	718
Applications of ϵ -entropy to the computation of n -widths. By J. W. JEROME and L. L. SCHUMAKER.....	719
Correction to "On strong Riesz summability factors of infinite series." By J. S. RATTI.....	723
Taming a surface by piercing with disks. By W. T. EATON.....	724
 SHORTER NOTE	
Solution to a problem posed by Kalicki. By DOLPH ULRICH.....	728
Index to Volume 22.....	730

CONTENTS

Vol. 22, No. 3 SEPTEMBER, 1969 Whole No. 123

	Page
Weakly mixing transformations which are not strongly mixing. By R. V. CHACON.....	559
Extension of operator valued set functions with finite semivariation. By P. W. LEWIS.....	563
Isometries between B^* -algebras. By ALAN L. T. PATERSON.....	570
Bounded and continuous random Fourier series on noncommutative groups. By ALESSANDRO FIGÀ-TALAMANCA.....	573
On the irreducibility of weighted shifts. By NOBORU SUZUKI.....	579
Purely transcendental subfields of $k(x_1, \dots, x_n)$. By A. EVYATAR and A. ZAKS.....	582
Note on relative p -bases of purely inseparable extensions. By J. N. MORDESON and B. VINOGRADÉ.....	587
Commutative semigroup laws. By ROBERT SCHWABAUER.....	591
The structure of O'/Ω over local fields of characteristic 2. By EDWARD A. CONNORS.....	596
A note on the index of a G -manifold. By HSU-TUNG KU and MEI-CHIN KU.....	600
Hyperbolic submanifolds of complex projective space. By PETER KIERMAN.....	603
A note on topological parallelizability. By K. VARADARAJAN.....	607
The Gauss realizability problem. By MORRIS L. MARX.....	610
A note on semifree actions of S^1 on homotopy spheres. By HSU-TUNG KU.....	614
A remark on the density character of function spaces. By GIOVANNI VIDOSSICH.....	618
The α -closure αX of a topological space X . By CHEN TUNG LIU.....	620
A countable minimal Urysohn space is compact. By R. M. STEPHENSON, JR.....	625
Compactifications of Hausdorff spaces. By PETER A. LOEB.....	627
On k -spaces. By D. D. WEDDINGTON.....	635
Monotone mapping properties of hereditarily infinite dimensional spaces. By J. M. YOHE.....	639
A general differential equation for classical polynomials. By B. D. AGRAWAL and I. K. KHANNA.....	646
Multiplicative inverses of solutions for Volterra-Stieltjes integral equations. By J. V. HEROD.....	650
Completely continuous inverses of ordinary differential operators. By ROBERT M. KAUFFMAN.....	657
Analytic continuation of holomorphic functions with values in a locally convex space. By WITOLD M. BOGDANOWICZ.....	660
The spectrum of a linear operator under perturbation by certain compact operators. By KENNETH K. WARNER.....	667
Some steady state properties of $(\int \tilde{f}(t) dt)/f(x)$. By VIVIENNE MAYES...	672
Principal homogeneous spaces for finite group schemes. By STEPHEN S. SHATZ.....	678

Continued on inside back cover