

Ergodic theory and dynamical systems

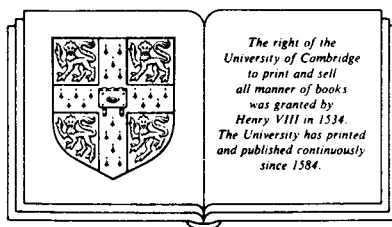
EDITORS

John Franks Hillel Furstenberg Anthony Manning William Parry

EDITORIAL BOARD

- | | |
|--|---|
| R. L. Adler (Thomas J. Watson
Research Center, Yorktown
Heights) | G. A. Margulis (USSR Acad. of
Sciences) |
| L. A. Bunimovich (P. P. Shirshov
Inst. of Oceanology, Moscow) | J. Moser (ETH, Zürich) |
| A. Connes (IHES) | Ya. B. Pesin (Pennsylvania State
University) |
| S. G. Dani (Mathematisches Institut,
Göttingen) | F. Przytycki (Polish Academy of
Sciences) |
| D. Fried (Boston University) | S. M. Rees (University of Liverpool) |
| M. R. Herman (Ecole Polytechnique,
Palaiseau) | D. J. Rudolph (University of
Maryland) |
| A. B. Katok (Pennsylvania State
University) | D. Ruelle (IHES) |
| U. Krengel (University of Göttingen) | D. Salamon (University of Warwick) |
| F. Ledrappier (University of Paris 6) | K. Schmidt (University of Warwick) |
| R. Mañé (IMPA) | J. P. Thouvenot (University of
Paris 6) |
| | P. Walters (University of Warwick) |

VOLUME 11
1991



CAMBRIDGE UNIVERSITY PRESS

CAMBRIDGE

LONDON NEW YORK PORT CHESTER
MELBOURNE SYDNEY

PUBLISHED BY
THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE

The Pitt Building, Trumpington Street, Cambridge CB2 1RP
40 West 20th Street, New York, NY 10011-4211, USA
10 Stamford Road, Oakleigh, Victoria 3166, Australia

© Cambridge University Press 1991

Printed in Great Britain by J. W. Arrowsmith Ltd, Bristol

Contents

PART 1 MARCH 1991

A class of examples of D -sequences	<i>T. A. Bick and J. Coffey</i>	1
Extensions à fibre constante	<i>F. Blanchard</i>	7
The ergodic theorem for additive cocycles of \mathbb{Z}^d or \mathbb{R}^d	<i>D. Boivin and Y. Derrienic</i>	19
Floquet exponents for Jacobi fields	<i>W. Craig</i>	41
Uniqueness and ergodic properties of attractive g -measures	<i>P. Hulse</i>	65
A method for proving that monotone twist maps have no invariant circles	<i>I. Jungreis</i>	79
Eventual factor maps and compositions of closing maps	<i>B. Kitchens, B. Marcus and P. Trow</i>	85
Rotation vectors and entropy for homeomorphisms of the torus isotopic to the identity	<i>J. Llibre and R. S. MacKay</i>	115
The weight-per-symbol polytope and scaffolds of invariants associated with Markov chains	<i>B. Marcus and S. Tuncel</i>	129
An area approach to wandering domains for smooth surface endomorphisms	<i>A. Norton</i>	181
Analysis of a procedure for finding numerical trajectories close to chaotic saddle hyperbolic sets	<i>H. E. Nusse and J. A. Yorke</i>	189
Local product structure for group actions	<i>A. Ramsay</i>	209

PART 2 JUNE 1991

Resolving factor maps for shifts of finite type with equal entropy	<i>J. Ashley</i>	219
Iterates of meromorphic functions: I	<i>I. N. Baker, J. Kotus and Lü Yinian</i>	241
An extension of Šarkovskii's Theorem to the n -od	<i>S. Baldwin</i>	249
On the number of caustics for invariant tori of Hamiltonian systems with two degrees of freedom	<i>M. Bialy</i>	273
Odometer actions on G -measures	<i>G. Brown and A. H. Dooley</i>	279
Alpha-congruence for dispersive billiards	<i>K. Eloranta</i>	309
The classification of non-singular actions, revisited	<i>Y. Katznelson and B. Weiss</i>	333

The structure of automorphisms of real suspension flows <i>B. K. Keynes, N. G. Markley and M. Sears</i>	349
Invariant curves and time-dependent potentials <i>S. Laederich and M. Levi</i>	365
Sur une nil-variété, les parties minimales associées à une translation sont uniquement ergodiques <i>E. Lesigne</i>	379
The C^1 closing lemma for non-singular endomorphisms <i>Lan Wen</i>	393

PART 3 SEPTEMBER 1991

The action of inert finite-order automorphisms on finite subsystems of the shift <i>M. Boyle and U.-F. Fiebig</i>	413
Rigidity of symplectic Anosov diffeomorphisms on low dimensional tori <i>L. Flaminio and A. Katok</i>	427
Systems of differential equations that are competitive or cooperative. VI: A local C^r closing lemma for 3-dimensional systems <i>M. W. Hirsch</i>	443
Exceptional minimal sets of $C^{1+\alpha}$ -group actions on the circle <i>S. Hurder</i>	455
Stability of Lyapunov exponents <i>F. Ledrappier and L.-S. Young</i>	469
On polynomials in primes and J. Bourgain's circle method approach to ergodic theorems <i>R. Nair</i>	485
Poisson limit law for Markov chains <i>B. Pittskel</i>	501
New estimates of Weyl sums and the remainder term in the law of distribution of the fractional part of a polynomial <i>L. D. Pustyl'nikov</i>	515
Can one always lower topological entropy? <i>M. Shub and B. Weiss</i>	535
\bar{d} -Convergence to equilibrium and space-time bernoullicity for spin systems in the $M < \varepsilon$ case <i>J. E. Steif</i>	547
The action at infinity of conservative groups of hyperbolic motions need not have atoms <i>J. A. Velling and K. Matsuzaki</i>	577
Local complexity growth for iterations of real analytic mappings and semicontinuity moduli of the entropy <i>Y. Yomdin</i>	583

PART 4 DECEMBER 1991

Iterates of meromorphic functions III: Preperiodic domains <i>I. N. Baker, J. Kotus and Lü Yinian</i>	603
Rotation and periodicity in plane separating continua <i>M. Barge and R. M. Gillette</i>	619
Smooth Markov partitions and toral automorphisms <i>E. Cawley</i>	633

Geodesic flows on manifolds of negative curvature with smooth horospheric foliations <i>R. Feres</i>	653
Random iterations of rational functions <i>E. Fornaes and N. Sibony</i>	687
Chain recurrence and attraction in non-compact spaces <i>M. Hurley</i>	709
Absorbing cantor sets and trapping structures <i>S. D. Johnson</i>	731
Groups acting freely on \mathbf{R} -trees <i>J. W. Morgan and R. K. Skora</i>	737
Spectral properties of a class of operators associated with maps in one dimension <i>D. Ruelle</i>	757
The Hausdorff dimension of Julia sets of entire functions <i>G. M. Stallard</i>	769
Entropy of dynamical systems and perturbations of operators <i>D. Voiculescu</i>	779
Lattice invariants for sofic shifts <i>S. Williams</i>	787
Integral formulas for the Laplacian along the unstable foliation and applications to rigidity problems for manifolds of negative curvature <i>Chengbo Yue</i>	803

INSTRUCTIONS TO AUTHORS

1 *Submission of typescripts*

Two copies of the manuscript should be submitted to one of the four Executive Editors (addresses on outside front cover). The editor will acknowledge receipt of the manuscripts. **It is important that authors inform the editor of any changes of address** whilst their paper is under consideration.

2 *Typescript*

Papers should be typed, double-spaced, on one side only and with generous margins. The pages must be numbered.

The first page should give the title, the author's name and institution, and a short abstract intelligible to mathematicians.

The title, while brief, must be informative (e.g. *A new proof of the ergodic theorem*, whereas *Some applications of a theorem of Birkhoff* would be useless).

3 *Notation*

It is important that mathematical expressions are clear to a printer (who is not a mathematician). For instance, n_k (n sub k) is common usage, but avoid if possible using c sub n sub k . Fractions are generally best expressed by a solidus. Complicated exponentials like

$$\exp \{z^2 \sin \theta / (1 + y^2)\}$$

should be shown in this and no other way.

In the typescript, italics, small capitals and capitals are specified by single, double and triple underlining. Bold-faced type is shown by wavy underlining.

It helps if displayed equations or statements which will be quoted later are numbered in order on the right of their line. They can then be referred to by, for example, 'from (7)'.
The author must enable the printer (if necessary by pencilled notes in the margin) to distinguish between similar symbols such as o , O , o , O , 0 ; x , X , \times ; ϕ , Φ , \emptyset ; l , 1 ; ϵ , \in ; κ , k .

There is no need to underline Greek or script letters provided these are clearly typed. Any special symbols should be explained on a separate sheet of directions for the printer.

If an author wishes to mark the end of the proof of a theorem, the sign \square may be used.

Footnotes should be avoided.

4 *Diagrams*

Figures and drawings should be on separate sheets in black ink. Photocopies are acceptable only if

they are as clear as the originals. *Symbols, legends and captions should be given on a transparent overlay*. Each text figure must be numbered as Figure 1, Figure 2, ... and its intended position clearly indicated in the typescript. The author's name in pencil must be on all separate sheets of diagrams.

A figure is expensive to reproduce and should be included only when the subject matter demands it, or when it greatly clarifies the exposition.

The publisher recognizes that some authors do not have the facilities for producing drawings of a sufficiently high standard to be reproduced directly and is therefore willing to have such diagrams re-drawn, provided that they are clear.

5 *Tables*

Tables should be numbered (above the table) and set out on separate sheets. Indicate the position of each in the text as for figures.

6 *References*

References should be collected at the end of the paper numbered in alphabetical order of the authors' names. A reference to a book should give the title, in italics, and then in roman type the publisher's name and the place and year of publication;

[4] N. Dunford & J. T. Schwartz *Linear Operators* Part I. Wiley: New York, 1958.

A reference to a paper should give in italics the title of the periodical, the number of the volume and year, and the beginning and end pages of the paper. Titles should be abbreviated as in *Mathematical Reviews*:

[6] J. E. Littlewood. The 'pits effect' for functions in the unit circle. *J. Analyse Math.* **23** (1970), 236-268.

7 *Proofs*

Authors receive one set of proofs for correction. If excessive alterations to the original manuscript are requested after the paper has been typeset, the author will be charged the cost of resetting. For papers with more than one author the proofs are sent to the first named author unless the editor receives other instructions. **It is important that proofs are corrected and returned promptly.**

8 *Reprints*

There are 100 reprints, free of charge, for each paper. For papers with several authors these reprints are divided between the authors. There are no page charges.

Ergodic theory and dynamical systems

VOLUME 11 PART 4 DECEMBER 1991

CONTENTS

<i>Baker, I. N., Kotus, J. and Yinian, Lü.</i> Iterates of meromorphic functions II: Preperiodic domains	603
<i>Barge, M. and Gillette, R. M.</i> Rotation and periodicity in plane separating continua	619
<i>Cawley, E.</i> Smooth Markov partitions and toral automorphisms	633
<i>Feres, R.</i> Geodesic flows on manifolds of negative curvature with smooth horospheric foliations	653
<i>Fornaes, E. and Sibony, N.</i> Random iterations of rational functions	687
<i>Hurley, M.</i> Chain recurrence and attraction in non-compact spaces	709
<i>Johnson, S. D.</i> Absorbing cantor sets and trapping structures	731
<i>Morgan, J. W. and Skora, R. K.</i> Groups acting freely on \mathbf{R} -trees	737
<i>Ruelle, D.</i> Spectral properties of a class of operators associated with maps in one dimension	757
<i>Stallard, G. M.</i> The Hausdorff dimension of Julia sets of entire functions	769
<i>Voiculescu, D.</i> Entropy of dynamical systems and perturbations of operators	779
<i>Williams, S.</i> Lattice invariants for sofic shifts	787
<i>Yue, Chengbo.</i> Integral formulas for the Laplacian along the unstable foliation and applications to rigidity problems for manifolds of negative curvature	803
Index to Volume 11	821

© Cambridge University Press 1991

CAMBRIDGE UNIVERSITY PRESS

The Pitt Building, Trumpington Street, Cambridge CB2 1RP

40 West 20th Street, New York, NY 10011-4211, USA

10 Stamford Road, Oakleigh, Victoria 3166, Australia

Printed in Great Britain by J. W. Arrowsmith Ltd, Bristol