Contents

STUART S. ANTMAN Nonlinear Continuum Physics I

IVO BABUŠKA · J. TINSLEY ODEN Computational Mechanics: Where Is It Going? 23

JOHN C. BAEZ · JAMES DOLAN From Finite Sets to Feynman Diagrams 29

DAVID H. BAILEY Experimental Mathematics:

JONATHAN M. BORWEIN Recent Developments and Future Outlook 51

BADI H. BALTAGI The Mathematical Aspects of Econometrics 67

OLE E. BARNDORFF-NIELSEN

RICHARD D. GILL · PETER E. JUPP Quantum Information 83

MASSIMO BERTOLINI The p-Adic L-Functions of Modular

HENRI DARMON Elliptic Curves 109

JEAN-PIERRE BOURGUIGNON A Basis for a New Relationship Between Mathematics and Society 171

ROGER BROCKETT New Issues in the Mathematics of Control 189

HERNÁN CENDRA

JERROLD E. MARSDEN Geometric Mechanics, Lagrangian Reduction,

TUDOR S. RATIU and Nonholonomic Systems 221

■ ACHIM BACHEM interviewed

by Vasco Alexander Schmidt Mathematics: From the Outside Looking in 275

Arjeh M. Cohen Communicating Mathematics Across the Web 28

HENRI COHEN Computational Aspects of Number Theory 301

J. Brian Conrey L-Functions and Random Matrices 331

Peter Constantin Some Open Problems and Research Directions

in the Mathematical Study of Fluid Dynamics 353

Mark Davis Mathematics of Financial Markets 361

Erik De Schutter Computational Neuroscience:

More Math Is Needed to Understand the Human Brain 381

RICK DURRETT Probability Theory – An Introduction to Its Applications 393

Weinan E Selected Problems in Materials Science 407

BJÖRN ENGQUIST · GENE GOLUB From Numerical Analysis to Computational Science 433

GERD FALTINGS Diophantine Equations 449

VIII Contents

■ LENNART CARLESON interviewed

by Björn Engquist After the 'Golden Age': What Next? 455

GERALD FARIN Shape 463

JÖRG FRAUENDIENER

ODED GOLDREICH

ROGER PENROSE Twistors and General Relativity 479

MIKHAEL GROMOV Possible Trends in Mathematics in the Coming Decades 525

Computational Complexity 507

JOZEF GRUSKA Quantum Computing Challenges 529

Peter Hall Statistical Science – Evolution, Motivation and Direction 565

NIGEL HITCHIN Global Differential Geometry 577

GERHARD HUISKEN Evolution Equations in Geometry 593

CHRISTOPHER R. JOHNSON

YARDEN LIVNAT · LEONID ZHUKOV Computational Field Visualization 605

David Hart · Gordon Kindlmann

CHRISTOPHER K. R.T. JONES Whither Applied Nonlinear Dynamics? 631

■ David Eisenbud *interviewed*

by Sara Robinson Mathematics Comes from Many Sources ... 647

JAY JORGENSON · SERGE LANG The Ubiquitous Heat Kernel 655

Frank Kelly Mathematical Modelling of the Internet 685
Claudia Klüppelberg Developments in Insurance Mathematics 703

Toshiyuki Kobayashi Discontinuous Groups for Non-Riemannian Homogeneous Spaces 723

NEAL KOBLITZ Cryptography 749

MAXIM KONTSEVICH · DON ZAGIER Periods 771

HANS PETTER LANGTANGEN How Should We Prepare the Students of Science and Technology

ASLAK TVEITO for a Life in the Computer Age? 809

MALCOLM S. LONGAIR Astrophysics and Cosmology in the 21st Century 827

WOLFGANG LÜCK L^2 -Invariants and Their Applications to Geometry, Group Theory

and Spectral Theory 859

KISHORE B. MARATHE A Chapter in Physical Mathematics: Theory of Knots in the Sciences 873

■ MATTHIAS KRECK interviewed

by Vasco Alexander Schmidt The Unity of Mathematics 889

DAVID R. MORRISON Geometric Aspects of Mirror Symmetry 899

YIANNIS N. Moschovakis What Is an Algorithm? 919

RISTO M. NIEMINEN From Number Crunching to Virtual Reality:

Mathematics, Physics and Computation 937

ALFIO QUARTERONI Modeling the Cardiovascular System: A Mathematical Challenge 961

Contents

DOUG ROBLE · TONY CHAN Math in the Entertainment Industry 971

MARIE-FRANÇOISE ROY Three Problems in Real Algebraic Geometry and Their Descendants 991

KYOJI SAITO Primitive Automorphic Forms 1003

Peter Schuster Mathematical Challenges from Molecular Evolution 1019

DIRK SELLE · WOLF SPINDLER

Bernhard Preim Mathematical Methods in Medical Imaging:

HEINZ-OTTO PEITGEN Analysis of Vascular Structures for Liver Surgery Planning 1039

DENIS SERRE Systems of Conservation Laws: A Challenge for the XXIst Century 1061

■ MASATAKE MORI

and Kyoji Saito interviewed

by Toshikazu Sunada

RIMS for the 21st Century 1081

JOEL SPENCER Discrete Probability 1095

DANIEL W. STROOCK Probability Theory – A Somewhat Narrow Perspective 1105

GERARD VAN DER GEER Error-Correcting Codes and Curves over Finite Fields 1115

Jan van Leeuwen

JIŘÍ WIEDERMANN The Turing Machine Paradigm in Contemporary Computing 1139

ANATOLY M. VERSHIK Randomization of Algebra and Algebraization of Probability –

An Attempt at Prediction 1157

MARCELO VIANA Dynamical Systems: Moving into the Next Century 1167

HANS VON STORCH

JIN-SONG VON STORCH Noise in the Climate System – Ubiquitous, Constitutive

Peter Müller and Concealing 1179

GÜNTER M. ZIEGLER Questions About Polytopes 1195

Biographies 1213



http://www.springer.com/978-3-540-66913-5

Mathematics Unlimited - 2001 and Beyond (Eds.)B. Engquist; W. Schmid 2001, XXX, 1237 p. 253 illus., 186 in color., Hardcover

ISBN: 978-3-540-66913-5