Felipe Cucker · Michael Shub (Eds.)

Foundations of Computational Mathematics

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Foundations of Computational Mathematics

Selected Papers of a Conference
Held at Rio de Janeiro, January 1997

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Preface

This book contains a collection of articles corresponding to some of the talks delivered at the *Foundations of Computational Mathematics* conference held at IMPA in Rio de Janeiro in January 1997. Some of the others are published in the December 1996 issue of the Journal of Complexity. Both of these publications were available and distributed at the meeting. Even in this aspect we hope to have achieved a synthesis of the mathematics and computer science cultures as well as of the disciplines.

The reaction to the Park City meeting on Mathematics of Numerical Analysis: Real Number Algorithms which was chaired by Steve Smale and had around 275 participants, was very enthusiastic. At the suggestion of Narendra Karmarmar a lunch time meeting of Felipe Cucker, Arieh Iserles, Narendra Karmarkar, Jim Renegar, Mike Shub and Steve Smale decided to try to hold a periodic meeting entitled "Foundations of Computational Mathematics" and to form an organization with the same name whose primary purpose will be to hold the meeting.

This is then the first edition of FoCM as such. It has been organized around a small collection of workshops, namely

- Systems of algebraic equations and computational algebraic geometry
- Homotopy methods and real machines
- Information-based complexity
- Numerical linear algebra
- Approximation and PDEs
- Optimization
- Differential equations and dynamical systems
- Relations to computer science
- Vision and related computational tools

There were also twelve plenary speakers.

The variety of topics is reflected in the pages that follow. They also reflect a variety of styles since the articles run from one-page abstracts to complete mathematical papers.

We are indebted to several people. First of all to the workshop organizers: Lenore Blum, Felipe Cucker, Wolfgang Dahmen, Jim Demmel, Ron DeVore,

Alan Edelman, Clovis Gonzaga, Arieh Iserles, Herb Keller, Thomas Lickteig, Jean-Michel Morel, David Mumford, Erich Novak, Marie-Françoise Roy, Imre Simon, Andrew Stuart, and Henryk Wozniakowski. They selected the papers which appear in this volume. Then, to the local organizing committe: Alfredo Iusem, Eric Goles, Teresa Krick, Gregorio Malajovich, Benar Fux Svatier, Martin Tygel, and Jorge Zubelli.

We are greatly indebted to IMPA for making their lovely facility available and for financial support. SIAM provided us with help as a cooperating society and the meeting was endorsed by the IMU. The CNPq, CAPES, FAPERJ and FINEP, all state agencies from Brasil also supported the organization of the conference. And the same holds true for IBM and the NSF. To all of these institutions we want to express here our gratitude.

We are also indebted with Springer Verlag whose efficiency allowed the publication of this book within a short period of time.

Felipe Cucker, *Publications*
Mike Shub, *Chair*
FoCM

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