Volume 39

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CRM PROCEEDINGS & LECTURE NOTES

Centre de Recherches Mathématiques
Université de Montréal

Group Theory and Numerical Analysis

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D. Gomez-Ullate
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American Mathematical Society

Group Theory and Numerical Analysis

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The Centre de Recherches Mathématiques (CRM) of the Université de Montréal was created in 1968 to promote research in pure and applied mathematics and related disciplines. Among its activities are special theme years, summer schools, workshops, postdoctoral programs, and publishing. The CRM is supported by the Université de Montréal, the Province of Québec (FCAR), and the Natural Sciences and Engineering Research Council of Canada. It is affiliated with the Institut des Sciences Mathématiques (ISM) of Montréal, whose constituent members are Concordia University, McGill University, the Université de Montréal, the Université du Québec à Montréal, and the Ecole Polytechnique. The CRM may be reached on the Web at www.crm.umontreal.ca.

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Preface

The Workshop on Group Theory and Numerical Analysis, organized under the auspices of the Centre de Recherches Mathématiques, Université de Montréal, took place in Montréal, Québec, May 26–31, 2003.

This meeting brought together scientists working in several different but mutually related areas. The unifying theme was the application of group theory and geometrical methods to the solution of differential and difference equations. The emphasis was on the combination of analytical and numerical methods and also the use of symbolic computation.

The workshop attracted 51 participants from 9 countries: Canada (24), USA (12), UK (5), Norway (3), Mexico (2), Russia (2), Australia (1), Italy (1), and Ukraine (1). A total of 34 lectures was presented.

The 20 contributions presented in this volume cover several (mutually overlapping) lines of research:

- *Lie group integrators, geometric integrators, exponential integrators* (Talks presented by A. M. Bloch/A. Iserles, E. Celledoni, D. Lewis, E. Mansfield/ G. R. W. Quispel, and B. Owren).

- *Symbolic computation and solutions of ordinary differential equations, partial differential equations and differential-difference equations* (Talks presented by D. Baldwin, W. Hereman, E. S. Cheb-Terrab, and G. Reid).

- *Symmetry preserving discretization of ordinary and partial differential equations* (Talks presented by C. Cyr-Gagnon, R. Kozlov).

- *Discrete and finite Fourier transforms and data processing* (Talks presented by A. M. Atoyan, J. Patera and K. B. Wolf).

- *Boundary layer perturbation theory and its symmetry respecting discretization* (Talk by C. M. Bender).

- *Discrete symmetries of difference and differential difference equations* (Talk by D. Levi).

- *Numerical methods for treating rapid oscillations* (Talk by A. Iserles).

- *Orthogonal polynomials related to Padé approximations* (Talk by A. Zhedanov).

- *Applications in biophysics and physics* (Talks by J. Tuszynski and W. Zakrzewski).

This volume has the character of a monograph and should represent a useful reference book for scientists working in this highly topical field.

Among the review talks presented at the Workshop, but not included in these Proceedings, we mention that at least two are available elsewhere, namely P. J. Olver's talk corresponds to the publication of P. Kim and P. J. Olver, *Geometric integration via multi-space*, Regular and Chaotic Dynamics **9** (2004), no. 3,

213–226 and P. Winternitz's talk is included in D. Levi, P. Winternitz, Continuous Symmetries of Difference Equations, in nlin.SI/0502004.

The Workshop Organizing Committee consisted of

- P. Winternitz (Chair, CRM, Université de Montréal, Canada).
- D. Gomez-Ullate (Universitat Politècnica de Catalunya, Barcelona, Spain).
- A. Iserles (Cambridge University, United Kingdom).
- D. Levi (Universita' degli Studi Roma Tre, Italy).
- P. J. Olver (University of Minnesota, Minneapolis, USA).
- R. Quispel (La Trobe University, Melbourne, Australia).
- P. Tempesta (SISSA, Trieste, Italy).

The organizers thank the CRM and NSF for financial support making the Workshop possible.

P. Winternitz
Montréal, April 2005

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