PROCEEDINGS

OF THE SEVENTEENTH SOUTH AFRICAN

SYMPOSIUM

ON

NUMERICAL MATHEMATICS

UMHLANGA ROCKS, 15-17 JULY 1991

SANUM & THE
DEPT. OF COMPUTER SCIENCE
UNIVERSITY OF NATAL
DURBAN

Proceedings of the seventeenth South African

SYMPOSIUM ON NUMERICAL MATHEMATICS

Umhlanga Rocks, 15-17 July 1991

Edited by

S Abelman

Published by the Department of Computer Science
University of Natal, Durban, 1991

ISBN 0 86980 824 9
ISSN 0379 8844

Preface

The seventeenth South African Symposium on Numerical Mathematics was held at the Breakers Hotel, Umhlanga Rocks from 15 to 17 July 1991. It was organized by the South African Society for Numerical Mathematics (SANUM), in conjunction with the Computer Science Department of the University of Natal, Durban. Thirty eight delegates attended the conference, and thirty papers were presented. The invited speakers from abroad were Prof. Rolf Jeltsch from ETH, Zürich, Switzerland, and Prof. Eli Levin from the Open University, Israel. Our local keynote speaker was Prof. Daya Reddy from the University of Cape Town. James Keiser a PhD student from the University of Colorado, Bolder, currently visiting the University of the O.F.S., also attended the Symposium and read a paper.

This collection of papers represents an excerpt of those delivered at the conference. Participants had a choice in deciding whether to submit an extended abstract, or a full length paper to these Proceedings. All contributions are published as received from the authors, without any refereeing or editing. Refereed Proceedings of this year's Symposium will be published in a special issue of Questiones Mathematicae. Dirk Laurie and Ben Herbst have been appointed as guest editors. The deadline for submission of papers for this special Q.M. issue is 30 September 1991.

De Beers Chairman's Fund Educational Trust is thanked for their generous support of this Symposium. Our sincere thanks also go to Sparc Systems for their sponsorship and their computer demonstration and display at the Symposium. The prize for the best paper delivered by a delegate under the age of 35 years was sponsored this year by Sparc Systems (the Sparc prize). The winner was Lance Vogel - congratulations! Previous prizewinners were Adrian Solomon in 1990 and in 1989 the prize was shared between André Weideman and Lance Vogel.

All contributors to the Symposium, chairpersons of sessions and participants are thanked for their participation. On behalf of the members of SANUM and all delegates present at the Symposium, I express a very sincere word of thanks to Ms. Ethel Carte of the Computer Science Department, University of Natal, Durban for her invaluable assistance with the organizing and smooth running of the Symposium and the publishing of these Proceedings. As always, it has been a great pleasure and privilege working with her.

Shirley Abelman
Secretary, SANUM.

PARTICIPANTS - DEELNEMERS

S ABELMAN	*University of the Witwatersrand*
M ASPOAS	*University of the Witwatersrand*
M L BAART	*Potchefstroomse Universiteit vir CHO*
N T BISHOP	*University of the Witwatersrand*
E CLOETE	*Overberg Test Range*
M A COETZEE	*Potchefstroomse Universiteit vir CHO*
K CROUS	*Krygkor*
A DU PLOOY	*Ematek, CSIR*
D EYRE	*Potchefstroom University for CHE*
D GREENBLATT	*Aerotek, CSIR*
B M HERBST	*University of the OFS*
M HONMAN	*Aerotek, CSIR*
R JELTSCH	*ETH Zurich, Switzerland*
J M KEISER	*University of Colorado, Bolder*
A KNOPFMACHER	*University of the Witwatersrand*
J M KOZAKIEWICZ	*University of Natal, Durban*
P J LAKE	*Aerotek, CSIR*
D P LAURIE	*Potchefstroomse Universiteit vir CHO*
A L LEVIN	*Open University of Israel*
N G LOCK	*University of the Witwatersrand*
D LORENZATO	*University of the Witwatersrand*
D S LUBINSKY	*University of the Witwatersrand*
S S MAKUMSHA	*University of the Witwatersrand*
E D MALAZA	*University of Transkei*
P N MANUEL	*University of Pretoria*
E MARÉ	*Raad vir Kernveiligheid*
M F MARITZ	*University of the OFS*
H G MILLER	*University of Pretoria*
G M OVENDEN	*University of the Witwatersrand*
B D REDDY	*University of Cape Town*
J REMAR	*University of Stellenbosch*
R A RITCHIE	*University of Pretoria*
J H SMIT	*Universiteit van Stellenbosch*
J J SPOELSTRA	*Potchefstroomse Universiteit vir CHO*
L STEYN	*Krygkor*
O UBBINK	*Krygkor*
D L VOGEL	*Atomic Energy Corporation*
D W VON OERTZEN	*University of Pretoria*

CONTENTS

page

Preface iii

Participants iv

S Abelman & D Eyre. *Exponentially fitted nonlinear methods based on continued fractions for solving stiff systems of ordinary differential equations.* 1

M Aspoas. *Numerical solution of differential–algebraic equations* 3

M L Baart & M A Coetzee. *C^2 and G^2 continuity of cubic B–splines. Part I: geometric continuity.* 5

N T Bishop. *The characteristic initial value problem in numerical relativity* 7

T Bloom, D S Lubinsky & H Stahl. *What distributions of points are possible for convergent sequences of interpolatory integration rules?* 9

E Cloete. *Some principles of missile tracking and data reduction.* 11

M A Coetzee & M L Baart. *C^2 and G^2 continuity of cubic B–splines. Part II: curve construction.* 5

A Du Plooy. *A multigrid technique applied to Poisson's equation.* 15

D Eyre. *Spline–Galerkin method for solving multidimensional Fredholm integral equations.* 17

D Greenblatt. *Numerical computation of the combined effect of wake–passing and turbulence on gas turbine blades.* 19

B M Herbst. *Symplectic methods for integrable Hamiltonian systems.* 21

M Honman. *Parallel approximate tridiagonal matrix equation solvers.* 23

R Jeltsch. (1) *Discrete hyperbolic conservation laws.* 25
(2) *The Courant–Friedrichs–Lewy condition with order equipped.* 27

J M Keiser. *A class of stable multi–state time–reversible cellular automata with rich particle content.* 29

A Knopfmacher. *Power product representations for functions.* 31

J M Kozakiewicz & J R Mika. *Multigrid algorithm for numerical solution of ordinary differential equations.* 33

P J Lake. *Construction of collision tables for 3 - D lattice gases.* 35

D P Laurie. *Stratified sequences of nested rules for fully adaptive quadrature.* 59

A L Levin. *L_p rational approximation to the Signum function and related problems.* 61

N G Lock. *Numerical solution of the Benjamin–Ono equation.* 63

M F Maritz. *Solitons in cellular automata and in Boolean difference equations.* 65

H G Miller & D Eyre. *An L^2 discretization scheme for continuum wavefunctions.* 67

G M Ovenden. *Numerical methods for iterative functional equations.* 69

B D Reddy. *Mixed and reduced integration finite element methods.* 71

J Remar. *Numerical solution of some one–phase Stefan problems.* 73

R A Ritchie, F Solms, D W von Oertzen, H G Miller & E D Malaza. *The maximum entropy principle applied to Hadron multiplicity distributions.* 75

J H Smit & R A Renaut. *Accuracy barriers of difference schemes for the wave equation.* 85

O Ubbink. *Optimering van versnelde voertuigtoetsing.* 87

D L Vogel. *Iterative inversion of matrices with complex eigenvalues.* 89