Proceedings
of the seventh South African

SYMPOSIUM ON NUMERICAL MATHEMATICS

Durban, 20, 21 & 22 July 1981



computer science department university of natal durban

Proceedings of the seventh South African

SYMPOSIUM

ON

NUMERICAL MATHEMATICS

Durban, 20, 21 and 22 July 1981.

edited by

G.R. Joubert

Report number CS.07.03.01.81

Published by the Computer Science Department, University of Natal, Durban 1981.

ISBN 0 86980 264 X

PREFACE

In 1975 the Department of Computer Science of the University of Natal organised the first South African Symposium on Numerical Mathematics in Durban. Since then these symposia have become an annual event. The seventh such symposium was held in Durban on 20, 21 and 22 July 1981.

These proceedings are a published record of most of the papers presented.

The choice was left to the authors as to whether they wished to publish their papers in full or as a summary or whether they preferred only an abstract to be published. All contributions included in the proceedings are published as received from authors.

Invited papers were read by Professor G. Hämmerlin, Professor J. Whiteman, Professor R.J.Y. McLeod and Dr. H. Voss.

The symposium was again supported financially by IBM South Africa. The continued support of IBM over the past six years has made it possible regularly to invite overseas speakers who have greatly contributed to the stimulation of research in this field in South Africa and neighbouring states.

At the last symposium it was decided by the delegates to form a separate society which will take over the responsibility for the organisation of future symposia.

Appreciation and thanks are due to Pat Duminy of the Public Relations Office of the University of Natal and to Ethel Carte and Wendy Midgley of the Computer Science Department for assisting with the organisation of the symposium. Ethne de Groot of the Computer Science Department has taken on the unenviable task of preparing the proceedings.

G.R. JOUBERT

PARTICIPANTS

- M.L. Baart (Council for Scientific and Industrial Research, Pretoria)
- A. Ben-Israel (Council for Scientific and Industrial Research, Pretoria)
- R.A.B. Bond (University of Natal, Durban)
- M. Brannigan (Council for Scientific and Industrial Research, Pretoria)
- J.H. de Klerk (Potchefstroom University for Christian Higher Education, Potchefstroom)
- J.P. du Plessis (University of Stellenbosch, Stellenbosch)
- D. Eyre (Council for Scientific and Industrial Research, Pretoria)
- J. Flachs (Council for Scientific and Industrial Research, Pretoria)
- G. Hämmerlin (Ludwig-Maximilians-Universität, München, West-Germany)
- C.E. Janeke (Consulting Engineer, Pretoria)
- G.R. Joubert (University of Natal, Durban)
- M. Laidlaw (University of Durban-Westville, Westville)
- D.P. Laurie (Council for Scientific and Industrial Research, Pretoria)
- A.J. Maeder (University of Natal, Durban)
- R. McLeod (Council for Scientific and Industrial Research, Pretoria)
- I.M. Navon (Council for Scientific and Industrial Research, Pretoria)
- H. Neishlos (Council for Scientific and Industrial Research, Pretoria)
- G.W. Reuter (Council for Scientific and Industrial Research, Pretoria)
- H.A. Riphagen (Council for Scientific and Industrial Research, Pretoria)
- L. Rolfes (Council for Scientific and Industrial Research, Pretoria)
- C.H. Rohwer (University of Zululand, Kwa-Dlangezwa, Zululand)
- E.E. Rosinger (Council for Scientific and Industrial Research, Pretoria)
- J.M. Sanz-Serna (Council for Scientific and Industrial Research, Pretoria)
- S.W. Schoombie (University of the Orange Free State, Bloemfontein)
- M. Sniedovich (Council for Scientific and Industrial Research, Pretoria)
- H. Tönsing (Council for Scientific and Industrial Research, Pretoria)
- J. van Heerden (Uranium Enrichment Corporation of S.A. (Ltd.), Pretoria)
- H. Voss (Universität Essen, Essen, West-Germany)
- H.R. Weistroffer (Council for Scientific and Industrial Research, Pretoria)
- J. Whiteman (Brunel University, Middlesex, England)
- C.J. Wright (University of the Witwatersrand, Johannesburg)
- Y. Yavin (Council for Scientific and Industrial Research, Pretoria)
- T.J. Ypma (University of the Witwatersrand, Johannesburg)

CONTENTS

T. T	200
	iii
Preface	iv
Participants	IV
New Developments in the numerical treatment of integral equations by G. Hämmerlin	1
Regions of absolute stability by J.M. Sanz-Serna	4
Finite elements and their use in treating elliptic problems involving boundary singularities by J.R. Whiteman	13
A fast convergence method for nonlinear difference schemes by diagonal approximation by E.E. Rosinger	15
Approximation of nonlinear terms in hyperbolic equations by G.W. Reuter	17
An alternative approach to nonlinear filtering: jump process observations by Y. Yavin	23
Performance measurements of parallel numerical algorithms on a simple MIMD computer by G.R. Joubert, A.J. Maeder & E. Cloete	25
O.D.E. simulation of engineering systems and the practical significance of Richardson extrapolation by R. Bond	37
Some quadratic quasiinterpolants by C.H. Rohwer	43
Stability of numerical schemes for fluid-structure interaction problems by H. Neishlos, M. Israeli & K. Kivity	55
Numerical prediction of laminar, helical flows by J.P. du Plessis	57
A global method for solving stiff systems by L. Rolfes	59
On the numerical solution of delay differential equations by C.J. Wright	61
A moving Petrov-Galerkin method for transport equations by S.W. Schoombie & B.M. Herbst	79
Solving the continuous L ₁ -approximation problem by means of minimization by J.H. de Klerk	83
Thermal swing in HVAC - a mathematical treatise C.E. Janeke	93
Looped updating for quasi-Newton methods by J. Flachs	103
Over-achievement programming for multiple objectives optimization by H.R. Weistroffer	105
A circularly exact predictor-corrector method for trajectory problems by R.J.Y. McLeod & J.M. Sanz-Serna	111
The EVP method of Roache for the solution of the Poisson equation by J. van Heerden	129
Generalized cross-validation and noisy ill-conditioned systems of linear equations by M.L. Baart	
On finding a multiple zero by T.J. Ypma	133

	pag
Spectral factorization of polynomials by D.P. Laurie	135
Computation of eigenvalues of nonlinear eigenvalue problems	
by H. Voss	147
New approaches to curved finite elements by R.J.Y. McLeod	159
On applications of F-convexity in numerical methods by A. Bon Januari	
& A. Ben-Tal	177
The application of blending-splines to solve integral equations	
approximately by G. Hämmerlin	195
A collocation method for the Lippman-Schwinger equation by D. Euro	201