

SYMPOSIUM  
ON  
NUMERICAL  
MATHEMATICS

DURBAN, 8-9 APRIL 1976



computer science department  
university of natal  
durban

**SYMPOSIUM ON NUMERICAL MATHEMATICS**

**DURBAN, 8 - 9 APRIL 1976**

Report number CS.07.03.01.76.

Published by the Computer Science Department,  
University of Natal, Durban 1976.

## PREFACE

Following the first national symposium on numerical mathematics held in South Africa during 1975 a number of requests were received for a similar symposium to be held in 1976. It was generally felt by researchers that such a forum was essential for the continued interest and research in this field.

Professor Peter Henrici from the Eidgenössische Technische Hochschule, Zürich kindly accepted an invitation to attend this symposium, during which he read two papers.

The visit by Professor Henrici was made possible through a generous donation by IBM South Africa.

In order to speed up the publication of the proceedings of the symposium all papers and abstracts are published in the form in which they were received from authors.

G. R. Joubert.

PARTICIPANTS

T.G. Alant (UCOR, Pretoria)  
R.A.B. Bond (University of Natal, Durban)  
C.A. Botsaris (CSIR, Pretoria)  
M. Brannigan (University of Natal, Durban)  
J.D. Buys (CSIR, Pretoria)  
P.H. Crous (University of Stellenbosch, Stellenbosch)  
A. Haller (University of the Western Cape, Bellville)  
P. Henrici (Eidgenössische Technische Hochschule, Zürich)  
D.A. Hunter (University of Durban-Westville, Durban)  
F. Jackson, (University of Cape Town, Cape Town)  
R. Jones (University of the Witwatersrand, Johannesburg)  
G.R. Joubert (University of Natal, Durban)  
D.P. Laurie (CSIR, Pretoria)  
M.H. Linck (University of Natal, Durban)  
J. MacKinnon (University of Stellenbosch, Stellenbosch)  
D.H. Martin (University of Natal, Durban)  
J.D. Neethling (Atomic Energy Board, Pretoria)  
G.G.S. Pegram (University of Natal, Durban)  
J.E. Radue (University of Natal, Durban)  
C.H. Rohwer (University of Zululand, Kwa-Dlangezwa)  
F.D. van Niekerk (University of Pretoria, Pretoria)  
P.J. Vermeulen (University of Pretoria, Pretoria)  
R.M. Walker (University of the Witwatersrand, Johannesburg)  
A. Wassying (University of the Witwatersrand, Johannesburg)

CONTENTS

	<u>Page</u>
Preface .....	iii
Participants .....	iv
Methods of descent for solving polynomial equations by P. Henrici ....	1
Newton's rule of signs and a necessary and sufficient set of conditions that the roots of a real algebraic equation shall be real and distinct by R.M. Walker .....	3
A new factorization algorithm for real polynomials by D.H. Martin ....	11
The solution of $Ax = b$ by D.S. Henderson and A. Wassyng .....	19
Function minimization by differential descent by C.A. Botsaris .....	23
Algorithm for the solution of the linear Tchebycheff problem by M. Brannigan .....	27
Explicit expressions for the perturbation of a linear system by R.A.B. Bond .....	37
A class of algorithms for unconstrained minimization based on numerical integration techniques by J.D. Buys .....	45
Parameter sensitivity of a dynamical system - with reference to the 'limits to growth' world model by P.J. Vermeulen .....	55
Numerical solution of the heat equation by J.A. Snyman and F.D. van Niekerk .....	57
Using diffusion equations to solve nonlinear two point boundary value problems by F. Jackson .....	67
An iterative finite element method for solving boundary value problems by R. Jones .....	83
New methods and experiments in numerical conformal mapping by P. Henrici .....	103
Step size control in parabolic equations by D.P. Laurie .....	111
Error estimate for the solution of a class of differential-difference equations by Newton's method by J.D. Neethling .....	119