Approximation Theory and Optimization

Tributes to M. J. D. Powell
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Contents

Preface ................................................................. vii

Submitted Talks ......................................................... ix

M.D. Buhmann & R. Fletcher: M.J.D. Powell’s contributions to numerical
mathematics ................................................................. 1

A brief review of M.J.D. Powell’s work in univariate and multivariate
approximation theory .................................................. 1

The contributions of Mike Powell to optimization ..................... 13

M.J.D. Powell’s publications ........................................... 19

I. Barrodale & C. Zala: MJDP–BCS industrial liaison: Applications to
defence science ......................................................... 31

C. de Boor: On the Meir/Sharma/Hall/Meyer analysis of the spline
interpolation error ....................................................... 47

M.D. Buhmann, C.A. Micchelli & A. Ron: Asymptotically optimal
approximation and numerical solutions of differential equations ......... 59

A.R. Conn, K. Scheinberg & Ph.L. Toint: On the convergence of derivative-
free methods for unconstrained optimization ................................ 83

I.C. Demetriou & M.J.D. Powell: Least squares fitting to univariate data
subject to restrictions on the signs of the second differences ............ 109

N. Dyn, F.J. Narcowich & J.D. Ward: A framework for interpolation and
approximation on Riemannian manifolds ................................ 133

R. Fletcher: Dense factors of sparse matrices ......................... 145

W. Gropp & J.J. Moré: Optimization environments and the NEOS
Server ............................................................................. 167

B.N. Parlett: New versions of qd for products of bidiagonals ........... 183

M.J. Todd: On adjusting parameters in homotopy methods for linear
programming ............................................................... 201
Preface

This volume comprises ten invited papers, presented at the Conference on Numerical Mathematics in Cambridge, on 27-30 July 1996.

The occasion being the sixtieth birthday of Professor M.J.D. Powell FRS, the main themes of the Cambridge conference were optimisation and approximation theory. These are the two principal areas of Mike Powell’s interest. During a distinguished career, first at AERE Harwell and, since 1976, as the John Humphrey Plummer Professor of Applied Numerical Analysis in Cambridge, Mike Powell made outstanding contributions to both subjects. It is impossible to imagine the present state of the art in either optimisation or approximation without Mike’s contribution!

The birthday party was an excuse for all of us to celebrate numerical analysis, listen to a variety of outstanding talks, debate computational mathematics in convivial and stimulating surroundings and, needless to say, meet again many old friends. Although the emphasis was on themes in optimisation and approximation, the range of the talks spanned all of numerical mathematics.

The many contributions of Mike Powell to the state of the art in modern numerical analysis were the leitmotif of the conference. It is a measure of Mike’s influence on the development of both subjects that his contributions are never far from the surface in these proceedings. The opening essay of the volume is devoted to a brief survey of Mike Powell’s work and it is accompanied by a list of his publications.

Many invited talks at the conference aimed at presenting summaries of the state of the art in a particular subject, while others introduced new research results. They combine to give timeliness and lasting value to the book; their quality reflects the general high standard of presentations at the meeting, not just of the invited but also the submitted papers. Indeed, the introspective examination of Mike Powell’s work during the last 35 years was an excellent opportunity to summarise the advances in nonlinear optimisation, spline theory, approximations with radial basis functions etc. We thank Mike for his many and profound contributions to numerical analysis and for giving us thereby the opportunity to hold this conference and collect the papers in this book. We are pleased to have been able to gather papers from almost all the invitees and thank them and all participants for their work.

Support for this conference came from the Department of Applied Mathematics and Theoretical Physics in Cambridge, from the London Mathematical Society and from Barrodale Computing Services. Thanks are also due to the staff of DAMTP and of Magdalene College, where many delegates lodged and where the ‘birthday party’ on 29 July took place. Particular gratitude is due to the younger members of the numerical analysis group in Cambridge, Aurelian Bejancu, Chris Faigle, George Goodsell, Sigitas Keras, Yunkang
Liu and Antonella Zanna, who have helped us both before and during the conference with a multitude of administrative arrangements. And we thank David Tranah and the staff of Cambridge University Press for their help with publishing this book.

We conclude on a personal note. The first of us was Mike Powell’s student and the second his colleague in Cambridge for nineteen years. Our knowledge and enjoyment of mathematics have been immensely influenced and transformed by Mike and our lives enriched by his friendship. May we thus conclude by wishing Mike many fruitful and happy years in numerical mathematics! We raise our glasses to papers yet to come.

Martin D. Buhmann

Arieh Iserles
Submitted Talks

“Visualizing the performance of minimization methods combined with deflation techniques”
G.S. Androulakis, T.N. Grapsa and M.N. Vrahatis (University of Patras)

“Shifted cardinal interpolation and elliptic functions”
B.J.C. Baxter (Imperial College) and N. Sivakumar (Texas A&M University)

“Fast evaluation of multiquadric and other radial basis functions”
R.K. Beatson (University of Canterbury, New Zealand) and G.N. Newsam (Defence Science Organisation, Australia)

“On the uniform and pointwise convergence of thin-plate splines”
A. Bejancu (University of Cambridge)

“Exponentially convergent linear rational interpolation between equidistant (and other) points?”
J.-P. Berrut (University of Fribourg) and H.D. Mitteimann (Arizona State University)

“Numerical solution of boundary integral equations by means of attenuation factors”
J.-P. Berrut and M. Reifenberg (University of Fribourg)

“Surface interpolation with constrained area”
M. Bozzini and M. Rossini (University of Milan)

“On the numerical solution of nonlinear Volterra integral equations with blow-up solutions”
H. Brunner (Memorial University of Newfoundland)

“Radial functions with compact support”
M.D. Buhmann (ETH Zürich)

“TV-norms and their applications”
O. Burdakov and B. Merkulov (CERFACS, Toulouse)

“Convexity preserving Powell–Sabin interpolants to scattered data”
J.M. Carnicer and M. Floater (University of Saragossa)

“Convergence of CG and GMRES in the Waveform Relaxation fixed point equation”
E. Celledoni and S. Maset (University of Trieste)
“Some indeterminate moment problems and Freud-like weights”
Y. Chen and M.E.H. Ismail (University of South Florida)

“Cubature formulas for two-dimensional integrals based on multivariate quasi-interpolating splines”
C. Dagnino and P. Lamberti (University of Turin)

“On the convergence of product formulas based on nodal spline interpolation for the numerical evaluation of certain two-dimensional Cauchy Principal Value integrals”
C. Dagnino, S. Perotto and E. Santi (University of Turin)

“FMG cycle with the preconditioning of explicit group-2 linear system”
D.S. Daoud and D. Subasi (Eastern Mediterranean University, Turkey)

“On theorems of the alternative and duality”
A. Dax (Hydrological Service, Israel)

“Piecewise monotonic divided differences for least squares smoothing of univariate data: A review of methods and software”
I.C. Demetriou (University of Athens)

“SQP interior-point methods for optimal control problems”
J.E. Dennis (Rice University), M. Heinkenschloss (Virginia Polytechnic Institute) and L.N. Vicente (Rice University)

“Peano kernels of noninteger order”
K. Diethelm (University of Hildesheim)

“Asymptotic properties of some generalized penalty methods for nonlinear programming”
C. Gonzaga and R. Castillo (Federal University of Santa Catarina, Brazil)

“A new iterative method for thin plate spline interpolation to data points in general position”
G. Goodsell (University of Cambridge)

“Optimizing noisy functions using a one-dimensional bisection method”
T.N. Grapsa, M.N. Vrahatis and G.S. Androulakis (University of Patras)

“Problems and progress in vector Padé approximation”
P. Graves-Morris (University of Bradford)

“At inventory model with discrete transportation costs: An alternative approach for optimization”
P.N. Gupta and V.K. Agarwal (JNV University, India)

“At Lyapunov function method in Hilbert spaces”
R.P. Ivanov (Bulgarian Academy of Sciences) and I.L. Raykov (Sheffield Hallam University)
“A derivative-free algorithm for unconstrained minimization by searching conjugate directions on parallel hyperplanes”
H. Kanemitsu, K. Yuriko, K. Hideaki and M. Shimbo (Hokkaido University)

“Design of wavelets: A problem in optimization”
J. Kautsky (Flinders University)

“Combining domain decomposition with waveform relaxation”
S. Keras (University of Bath)

“Initial values for the inverse Toeplitz eigenproblem”
D. Laurie (Potchefstroom University, South Africa)

“Discrete approximation and convergence in $L^\infty$”
R. Lepp (Institute of Cybernetics, Tallinn)

“Analysis of a collocation method for integrating rapidly oscillatory functions”
D. Levin (University of Tel Aviv)

“Numerical methods for hybrid systems”
Y. Liu (University of Cambridge)

“Real versus interval methods for global optimization”
K. Madsen (Technical University of Denmark)

“Optimization problems arising in matrix and operator theory”
R. Mathias (College of William and Mary)

“Asymptotic error analysis in the finite element method”
D. Mayers (University of Oxford)

“The relationship between scaling and ill-conditioning in thin-plate spline systems”
G. Newsam (Defence Science Organisation, Australia)

“Numerical solution of partial differential equations with boundary singularities using the singularity subtraction technique”
C.K. Pan and K.M. Liu (City University of Hong Kong)

“Numerical estimation of projection constants”
K. Petras and C. Helzel (Technical University of Braunschweig)

“One the behaviour of a particular class of refinable functions”
F. Pitolli (University of Rome La Sapienza)

“Log-sigmoid rescaling in constrained optimization”
R.A. Polyak (George Mason University)

“Optimally choosing non-constant weighting for the smoothing spline”
B.C. Pringle and K.W. Bosworth (Idaho State University)
“Spectral properties of the modified Chebyshev pseudospectral method”
R. Renault (Arizona State University)

“An algorithm for selecting a good value for the parameter c in radial basis interpolation methods”
S. Rippa (Orbitech, Israel)

“A new SQP algorithm for large-scale NLP”
R. Sargent (Imperial College)

“Extrapolation techniques and the collocation method for some boundary integral equations”
F.-J. Sayas and R. Celorrio (University of Saragossa)

“Powell–Sabin splines in restricted approximation”
J.W. Schmidt (Technical University of Dresden)

“Risk management and optimization”
D. Siegel (IBM, Germany)

“ABS linear solvers for optimization”
E. Spedicato (University of Bergamo)

“Fast Fourier transform on 2-spheres”
G. Steidl (University of Darmstadt)

“On approximate variants of classical iterative methods”
O. Vaarmann (Tallinn Technical University)

“Complex and analytic splines in the extremal problems of the approximation theory and the numerical analysis”
S.B. Vakarchuk and V.I. Zabutnaya (National Ukrainian Academy of Sciences)

“Spectral signature classification via wavelet coefficient nonparametric density estimation”
E. Velásquez and K.W. Bosworth (Idaho State University)

“Wavelet data denoising and function estimation: bayesian approach”
B. Vidakovic (Duke University)

“Modifications of Armijo’s method”
M.N. Vrahatis, G.S. Andrilakis and T.N. Grapsa (University of Patras)

“A new efficient ODE solver of 3-stage, fourth order for solving initial value problems”
N. Yaacob and B.B. Sanugi (Malaysian University of Technology)
“Entropies of classical orthogonal polynomials with an unbounded supports”
R.J. Yáñez (University of Granada), J.S. Dehesa (University of Granada),
W. van Assche (Catholic University, Leuven) and A.I. Aptekarev (Moscow
State University)

“On the unicity of segmented $L_1$ approximations”
N. Yang (Fen Jen Catholic University, Taiwan)

“The method of iterated commutators for ordinary differential equations on
Lie groups”
A. Zanna (University of Cambridge)

“Fitting B-spline curves and surfaces via ODR”
D. Zwick (double star Research, St Augustin, Germany)