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Progress in Engineering Computational Technology

Edited by
B.H.V. Topping and C.A. Mota Soares

SAXE-COBURG
PUBLICATIONS

© Saxe-Coburg Publications, Stirling, Scotland

published 2004 by
Saxe-Coburg Publications
Dun Eaglais
Station Brae, Kippen
Stirling, FK8 3DY, Scotland

Saxe-Coburg Publications is an imprint of Civil-Comp Ltd

ISBN 1-874672-22-9 hardback

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Cover Images: CFD was used to understand the complex flow fields and pressure distribution around the damaged space shuttle. The analysis was performed at NASA Langley. The images were prepared by the ODU Center for Advanced Engineering Environments, Hampton VA, USA.

Printed in Great Britain by Bell & Bain Ltd, Glasgow

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Preface

This volume comprises the Invited Lectures presented at The Fourth International Conference on Engineering Computational Technology (ECT 2004) held at Lisbon, Portugal, from 7 to 9 September 2004. The ECT conference series began in Edinburgh during 1998. The 2004 conference was held concurrently with The Seventh International Conference on Computational Structures Technology (CST 2004). The venue for both the 2004 conferences was the National Civil Engineering Laboratory (LNEC) in Lisbon.

This volume includes fifteen papers concerned with key aspects of current research interest in the engineering computational technology field which includes computational methods for all branches in engineering and the latest developments in computational hardware and software.

In Chapter 1, Profesor Noor reviews the development of modelling, simulation and visualisation technologies. This chapter builds on a series of papers that Professor Noor has presented at the CST and ECT conference series, since 1991. In this paper he describes the role of distributed collaboration, the integration of computer resources with new tools, facilities and processes that are creating a fundamental paradigm shift in the modelling, simulation and visualisation for engineering.

In Chapter 2, Dr Müller-Hannemann describes recent advances in hexahedral mesh generation. He demonstrates some of the features using examples in biomechanics. In Chapter 3, Professor Habashi and colleagues describe the use of a three-dimensional mesh adaption module in computational fluid dynamics. Professor Jimack reviews the use of adaptive algorithms for the solution of free surface problems in Chapter 4. The techniques have applications to problems of thin liquid films.

Professor Montero and colleagues provide a review of techniques for the solution of large sparse linear systems of equations. In Chapter 6, Professor Cross, describes techniques for computational modelling of thermal-fluid-structure interaction. The simulation of this type of interaction provides an efficient solution to a number of important multi-physics problems. Professor Kwon, presents a multi-scale modelling

technique for laminated woven fabric composite structures. This is an example of a method that links the nanoscale to macroscale. Profesor Lackner and colleagues continue the multi-scale theme in Chapter 6 by an application to flexible road pavements.

In Chapter 9, Dr Sienz describes the simulation and optimization of injection moulding problems. This is another important example of the solution of an industrial multiphysics problem. Professor Meguid, reviews the advances in computational contact mechanics, in Chapter 10.

In Chapter 11, Professors Sugiyama and Shabana review the theoretical and numerical aspects of the analysis of large and plastic deformations of constrained multi-body systems. Profesor Gastaldi and colleagues describe the formulation of the finite element approach to the immersed boundary method in Chapter 12. This fluid-structure interaction problem has many applications including important biomechanics simulations.

Chapters 13 and 14 both relate to parallel computations. In the former, Dr Kruis reviews the use of three domain decompostion methods to engineering computations. In the latter, Profesor Cognard and colleagues, continue this theme by reviewing the use of parallel techniques for non-linear structural analysis.

Finally in Chapter 15, Profesor Hadipriono describes new aproaches to avoid premeditated destructive events in buildings. This involves the development of criminogenic design methodologies using virtual environments with the objective of minimising the buildings' susceptability to terrorist attack.

We are grateful to the authors and co-authors of the invited lectures included in this volume. Their contribution both to the conferences and this book is greatly appreciated. We are indebted to Professor A.K. Noor and J. Peters at the Center for Advanced Engineering Environments, Old Dominion University, NASA Langley Research Center, United States of America for the two computer generated images shown on the cover of this book.

Other papers presented at the conferences in 2004 are published as follows:

- *The Invited Lectures from CST 2004 are published in:*
  Progress in Computational Structures Technology, B.H.V. Topping and C.A. Mota Soares, (Editors), Saxe-Coburg Publications, Stirling, Scotland, 2004.
- *The Contributed Papers from CST 2004 are published in:*
  Proceedings of the Seventh International Conference on Computational Structures Technology, B.H.V. Topping and C.A. Mota Soares, (Editors), (Book of Abstracts and CD-ROM), Civil-Comp Press, Stirling, Scotland, 2004.

- *The Contributed Papers from ECT 2004 are published in:*
  Proceedings of the Fourth International Conference on Engineering Computational Technology, B.H.V. Topping and C.A. Mota Soares, (Editors), (Book of Abstracts and CD-ROM), Civil-Comp Press, Stirling, Scotland, 2004.

These conferences could not have been orgainsed without the help and support of many people. We would like to thank Professor Cristovão Mota Soares (IST) for all his kind help during the planning and organisation of these conferences. No trouble, task or problem was too great for him and we are grateful for his perseverance. We are also grateful to Professor Carlos Pina (LNEC) who so kindly helped us with the logistics of using the LNEC conference facilities.

We are grateful for Jelle Muylle (Civil-Comp Press) for designing and organising this and the other three volumes of conference proceedings (listed above). In addition, his development of the conference IT systems made sure that we could keep everything on track during the months of preparation of these volumes. The task was particularly onerous this year with more than twice the number of papers included in the four volumes than was originally anticipated. Once again, we would like to thank Judy Tait (Civil-Comp Press) for her organisational skills, which were greatly appreciated.

We both wish to acknowledge and express our gratitude to the conference sponsors:

- Technical University of Lisbon,
- Instituto Superior Tecnico, Lisbon,
- National Laboratory for Civil Engineering (LNEC), Lisbon,
- International Journal of Computers & Structures (Elsevier Science Ltd), and
- Advances in Engineering Software (Elsevier Science Ltd).

Finally, we should like to thank the members of the ECT 2004 Conference Editorial Board for their help before and during the conference: Professor K. Abe, Japan; Professor M.H. Aliabadi, UK; Professor A.J. Baker, USA; Professor Z.P. Bazant, USA; Professor A.I. Beltzer, Israel; Professor A.C. Benim, Germany; Professor M. Bercovier, Israel; Professor R.I. Borja, USA; Professor T. Burczynski, Poland; Dr F. Cai, Japan; Dr W. Chen, USA; Dr H.-P. Cheng, USA; Dr B. Codenotti, Italy; Dr S. Commend, Switzerland; Dr M. Connell, Sweden; Dr J.R. Corney, UK; Professor L. Damkilde, Denmark; Dr K. Davey, UK; M. Dayde, France; Professor G. Degrande, Belgium; Dr S. del Giudice, Italy; Dr C. Di Napoli, Italy; Professor E. Dick, Belgium; Professor I.S. Duff, UK; Dr B. Feijo, Brazil; Professor W. Frank, Germany; Professor U. Gabbert, Germany; Dr D.F. Griffiths, UK; Professor B. Gustafsson, Sweden; Professor W.G. Habashi, Canada; Dr M. Hirokane, Japan; Dr S.R. Idelsohn, Argentina;

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B.H.V. Topping and C.A. Mota Soares