Computational Science, Engineering and Technology Series: 35

Computational Methods for Engineering Technology

Saxe-Coburg Publications on Computational Engineering

Patterns for Parallel Programming on GPUs
Edited by: F. Magoulès

Tall Buildings: Design Advances for Construction
Edited by: J.W. Bull

Developments in Parallel, Distributed, Grid and Cloud Computing for Engineering
Edited by: B.H.V. Topping and P. Iványi

Trends in Parallel, Distributed, Grid and Cloud Computing for Engineering
Edited by: P. Iványi and B.H.V. Topping

Civil and Structural Engineering Computational Methods
Edited by: Y. Tsompanakis P. Iványi and B.H.V. Topping

Substructuring Techniques and Domain Decomposition Methods
Edited by: F. Magoulès

Computational Methods for Engineering Science
Edited by: B.H.V. Topping

Computational Methods for Acoustics Problems
Edited by: F. Magoulès

Mesh Partitioning Techniques and Domain Decomposition Methods
Edited by: F. Magoulès

Object Oriented Methods and Finite Element Analysis
R.I. Mackie

Programming Distributed Finite Element Analysis
R.I. Mackie

Computer Aided Design of Cable-Membrane Structures
B.H.V. Topping and P. Iványi

Domain Decomposition Methods for Distributed Computing
J. Kruis

Computational Methods for Engineering Technology

Edited by
B.H.V. Topping and P. Iványi

© Saxe-Coburg Publications, Stirlingshire, Scotland

published 2014 by
Saxe-Coburg Publications
Dun Eaglais
Station Brae, Kippen
Stirlingshire, FK8 3DY, UK

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

Computational Science, Engineering and Technology Series: 35
ISSN 1759-3158
ISBN 978-1-874672-65-4

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

Publisher's production and editorial team: Steven Miller, Jane Tabor, Rosemary Brodie

Printed in Great Britain by Bell & Bain Ltd, Glasgow

Contents

Editorial **iii**

1 Frontiers in Finite Element Procedures & Applications 1
K.J. Bathe

2 Digital Manufacturing in the Cloud 41
W. Gentzsch

3 Advances in Symbolic and Numerical Approaches in Computational Mechanics 61
D. Eyheramendy, S. Lejeunes, R. Saad and L. Zhang

4 Influence of Developments in Software Engineering on Finite Element Analysis 89
R.I. Mackie

5 Simple Homogenization Models for the Limit and Non-Linear Analysis of Masonry Structures Loaded In- and Out-of-Plane 111
G. Milani

6 Numerical Approaches for Brittle Crack Propagation 135
C.J. Pearce, R. MacKenzie and L. Kaczmarczyk

7 Multi-Scale Methods for Transport Problems: Theory and Applications 157
J. Geiser

8 On a Class of Inexact Type Methods Based on Generic Approximate Sparse Inverses Multigrid Method for Solving Nonlinear Partial Differential Equations 191
G.A. Gravvanis and C.K. Filelis-Papadopoulos

9 Response Variability Bounds of Elastic Beams with Uncertain Parameters 223
G. Muscolino and A. Sofi

10 On the Distributional Approach in Some Problems of Structural Mechanics 255
A. Baratta

11 Multiscale Models for Flow in Heterogeneous Media with Applications to Fresh Concrete 291
B. Patzák, F. Kolařík and J. Zeman

12 Recent Advances in the Finite Element Force Method 305
A. Kaveh and M.S. Massoudi

13 Optimized Design of Computer Experiments: A Review 325
E. Myšáková, A. Pospíšilová and M. Lepš

14 Recent Advances in Real Time and Hybrid Simulation for Earthquake Engineering Purposes 345
A. Sextos, E. Bousias and O. Taskari

Author Index **363**

Keyword Index **365**

Editorial

This volume comprises the Invited Lectures presented at *The Twelfth International Conference on Computational Structures Technology* (CST 2014) and *The Ninth International Conference on Engineering Computational Technology* (ECT 2014) held concurrently in Naples, Italy from 2-5 September 2014.

We are grateful to the authors and co-authors of the Invited Lectures included in this book. Their contribution to these conferences and this book is greatly appreciated.

Other papers presented at these conferences are published as follows:

- *The Invited Review Lectures from CST 2014 and ECT 2014 are published in:*
  Computational Technology Reviews, Volumes 9 & 10, Saxe-Coburg Publications, Stirlingshire, Scotland, 2014.

- *The Contributed Papers from CST 2014 are published in:*
  Proceedings of The Twelfth International Conference on Computational Structures Technology, B.H.V. Topping and P. Iványi, (Editors), (Book of Summaries with online delivery of full-text papers), Civil-Comp Press, Stirlingshire, Scotland, 2014.

- *The Contributed Papers from ECT 2014 are published in:*
  Proceedings of the Ninth International Conference on Engineering Computational Technology, P. Iványi and B.H.V. Topping, (Editors), (Book of Summaries with online delivery of full-text papers), Civil-Comp Press, Stirlingshire, Scotland, 2014.

We are grateful to Dawn Sewell for her administrative support before and during the conferences. We would like to thank Steven Miller for his care and attention in preparing these papers for publication.

Professor B.H.V. Topping
University of Pécs, Hungary &
Heriot-Watt University, Edinburgh, UK

Professor P. Iványi
Pollack Mihály Faculty of Engineering
and Information Technology
University of Pécs, Hungary