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Front cover: A rendering of a deformed mesh after simulated punching of a reinforced fabric.
Back cover: Simulated crushing of a twill weave fabric.
Both images are reproduced courtesy of Ph. Boisse and J.L. Daniel. For more information please refer to Chapter 12.

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Contents

Preface

This volume comprises the Invited Lectures presented at The Seventh International Conference on Computational Structures Technology (CST 2004) held at Lisbon, Portugal, from 7 to 9 September 2004. The CST conference series began in Edinburgh during 1991. The 2004 conference was held concurrently with The Fourth International Conference on Engineering Computational Technology (ECT 2004). The venue for both the 2004 conferences was the National Civil Engineering Laboratory (LNEC) in Lisbon.

This volume includes fourteen papers on key aspects of current research interest in the computational structures technology field, which includes computational structural mechanics and the latest developments in computational hardware and software. In Chapter 1, Professor Rolfes and colleagues described the use of new design tools for lightweight aerospace structures. The paper is concerned with the fibre orientation for structures designed from carbon fibre reinforced plastics (CFRP). This is the first of a number of lectures in this volume on the analysis and design of composite structures and materials.

Professors Muscolino and Cacciola review the use of re-analysis techniques in structural dynamics in Chapter 2. The object of re-analysis is to determine the response of a modified structure using the structural analysis of the original unmodified structure. Re-analysis techniques are as relevant today as when they were first developed for static problems some thirty five years ago. Professor Bouillard and colleagues, review numerical modelling of wave propagation in Chapter 3. Their lecture demonstrates that for the medium frequency range satisfactory numerical procedures are still difficult to achieve as a result of the dispersion error.

The role of algebraic graph theory in structural mechanics is reviewed in Chapter 4 by Professor Kaveh. Developments in this field have implications for the solution of equations and decomposition techniques for parallel computing. In Chapter 5, Professors Xiao and Karihaloo provide a review of stress recovery techniques. They decribe a statically admissible stress recovery technique that is applicable to both the finite element and meshless methods. Professor Doltsinis describes concepts related to the

loss of stabilty in quasistatic deformation of solids in Chapter 6.

In Chapter 7, Professor Bursi and colleagues review recent research into structural system identification for damage detection in reinforced concrete and steel-concrete structures. Professor Papa surveys research on mesoscopic and macroscopic consitutive laws for masonry in Chapter 8. He also presents two damage mechanics models for the analysis of masonry structures. Dr Bay and colleagues describe recent research on the structural and failure analysis of multimaterial structures in Chapter 9. They present a series of models to demonstrate the efficacy of the numerical methods.

Professor Benjeddou reviews trends in modelling and simulation of adaptive structures and composites in Chapter 10. His paper provides a review of thermo-electro-elasticity, benchmarking and future directions for this field. Chapter 11, by Professor Mota Soares and colleagues, continues the theme of composites by reviewing recent research on the modelling and analysis of laminated shells with embedded or surface bonded piezoelectric actuators or sensors. The theme of composites is continued in Chapter 12, where Professor Boisse and colleagues review the numerical modelling of continuous fibre composite forming procedures. Professor Balachandran discusses the oscillation of piezoelectric micro-scale resonators in Chapter 13.

In Chapter 14, Professors Frangopol and Neves review the probabilistic maintenance and optimization strategies for deteriorating civil infrastructures with emphasis on bridges. A model is developed using the condition-safety approach and examples of its application presented.

We are grateful to the authors and co-authors of the invited lectures included in this volume. Their contributions both to the conferences and this book are greatly appreciated. We are indebted to Professor P. Boisse of INSA de Lyon, Villeurbanne, France 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 ECT 2004 are published in:*
  Progress in Engineering Computational Technology, B.H.V. Topping and C.A. Mota Soares, (Editors), Saxe-Coburg Publications, Stirling, Scotland, 2004.
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tional 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 organised 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:

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