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SAXE-COBURG PUBLICATIONS
EDINBURGH

published 2000 by
Saxe-Coburg Publications
10 Saxe-Coburg Place
Edinburgh, EH3 5BR, UK

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

ISBN 1-874672-06-7

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

Cover Image: Transonic flow around the THRUST Supersonic Car
showing contours of pressure, stream ribbons and isosurfaces
Courtesy of E.A. Turner-Smith, Department of Civil Engineering, University of Wales, Swansea.

Printed in Great Britain by Bell & Bain Ltd, Glasgow

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Preface

The Second Euro-Conference on Parallel and Distributed Computing was held in Sintra, Portugal between 4 and 9 April 1998. This Euro-Conference series was supported by the European Commission Training and Mobility of Researchers Programme under contract no: ERBMMACT960072 with Civil-Comp Limited. As well as the lectures published in this book, a number of research presentations were made at the Second Euro-Conference. The text of these presentations is published in "Advances in Computational Mechanics with High Performance Computing", Edited by B.H.V. Topping, Civil-Comp Press, Edinburgh, ISBN 0-948749-54-7, 1998.

The current book builds on the lectures presented at the First Euro-Conference, previously published in "Parallel and Distributed Processing for Computational Mechanics: Systems and Tools", Edited by B.H.V. Topping, Saxe-Coburg Publications, 1999.

The lectures in the current book include both review chapters and descriptions of a body of work from well established researchers in the field. In the first chapter the use of parallel processing techniques used in the visualisation of engineering data is presented. Here large finite element meshes of 5 to 20 million elements are used for fluid dynamics and electro-magnetics problems. It is shown that subsequent visualisation of the data requires multi-processor computation for effective interactive display.

In the second chapter the use of the Message Passing Interface (MPI) library in writing parallel finite element programmes is described. In the third and fourth chapters the mesh generation and mesh refinement methods for the finite element method are reviewed. In Chapter 5 the use of partitioning methods for finite element meshes is reviewed. Comparative studies are described using a number of software tools.

In Chapter 6, the main issues relating to the development of software for parallel mesh adaptivity are reviewed. This chapter introduces the features of dynamic load balancing in relation to a parallel solver. Chapter 7 reviews the use of the dual substructuring method for structural mechanics problems.

The next three chapters introduce the use of object oriented techniques to parallel processing. In Chapter 8 an object oriented programming environment for the development of parallel programs is introduced. Chapter 9 describes an object oriented approach to finite element programming. Chapter 10 builds on the previous two chapters by describing the parallelisation of an object oriented finite element program.

The final three chapters consider the use of parallel design optimization algorithms in structural mechanics. In Chapter 11 evolution strategies and genetic algorithms for structural optimization are discussed. In Chapter 12 the parallelisation of these meth-

ods and their application to structural mechanics problems are reviewed. In Chapter 13 the application of evolutionary algorithms to large scale structural optimisation problems is described.

We are grateful for the valued help of many people in the organisation of the Second Euro-Conference. We should like to thank all at Civil-Comp Ltd for their help and perseverance in the realisation of this conference, particularly Dr Martin Sales. The assistance of members of the Structural Engineering Computational Technology Research Group at Heriot-Watt University, Edinburgh is gratefully acknowledged, especially Peter Iványi and Jelle Muylle.

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