Guest Editorial: Massive Parallel Computing

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Guest editorial

Massive parallel computing

This special issue of *FGCS* presents a selection of 14 papers selected from two workshops: The MeikUS '93 conference held at the University of Southampton in the UK and the Parsytec Campp '93 held at the University of Amsterdam in the Netherlands. The aim of the workshops was to attract papers from researchers and developers to demonstrate the ongoing research in massively parallel computing. During the workshops the state-of-the-art in the development of new applications, algorithms and tools/paradigms for MPP was reported. The papers presented at these workshops clearly indicate that the field of parallel scientific computing has grown significantly over the past few years. This is no doubt a consequence of the national and international political (and financial) emphasis on high performance computing. Although massively parallel computing is by no means a 'proven technology' for all compute-intensive or data-intensive applications, the research presented in this *FGCS* issue demonstrates the large impact it is already having in many areas of scientific computing.

We have organised this issue of *FGCS* in three categories: Applications, Algorithms and Tools/paradigms.

The first 5 papers are concerned with scientific applications. In the first paper Janssen and Lin describe a novel domain decomposition strategy for electron beam dose calculations in 3-dimensional media. The second paper by van Opheusden and Bos describes the parallelisation of a Brownian Dynamics simulation of Lennard-Jones particles. The physical properties of the gel simulated are compared with a confocal scanning image of a real gel arising from casein micelles. The next paper by Roest and Vollebregt discusses the numerical simulation of three-dimensional shallow water equations to predict the flows and transport in the continental shelf region, with emphasis on load balancing issues. Golby and Leschziner report on the simulation of a turbulent transonic flow. They describe a tile-decomposition strategy that results in high parallel efficiency. The last paper in this section, by Bousri, addresses the use of a nodal method of second order to simulate diffusion equations used in nuclear reactor theory.

The 4 papers in the algorithmic section start with a parallel conjugate gradient implementation on a 512-node system by Crone. The domain decomposition shows interesting scalability behaviour for large systems. The second paper by Monga-Made takes up the challenge of conditioning sparse matrices through parallel block preconditioning. In the next paper Verhoeven, Aarts and Swinkels present a novel scalable parallel local search algorithm based on data parallelism. Their method is analysed via a Travelling Salesman Problem with several thousands of cities on a 512-node machine. Pringle concludes this section with an implementation of a hierarchical tree algorithm. Here emphasis is on the Fast Multipole Method in 2 dimensions. The suggested communication strategies seem very promising and might be applicable to other types of parallel hierarchical algorithms.

In the last section on tools and paradigms 5 papers were selected. The first paper by Allen, Cramb and Upstill describes a suite of software tools that can be used when porting large complex relational database applications to parallel

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systems. In the second paper Caerts, Lauwereins and Peperstraete present a process-level debugger as a new module in their hierarchical graphical programming environment used in the development of concurrent programs. Methods to provide portable parallel interfaces to parallel computers are discussed by Bruce, Chapple, MacDonald, Trew and Trewin. They describe the ideas behind the design and implementation of a message passing layer and a library of utilities that allow users to reuse their parallel codes. The next paper by Vuurpijl, Schouten and Vytopil reports on a performance prediction model for indicating the execution behaviour of artificial neural networks on MIMD platforms. The last paper in the issue by Keane, Grant and Xu outlines the concepts of Virtual Shared Memory (VSM) versus shared memory and distributed memory. They argue that new developments in implementation of the concepts of VSM will have a major impact on the parallel computing community. The paper discusses the various models and presents some clarifying case studies on this topic.

We trust that you will enjoy reading the papers as much as we did.

We would like to thank the authors of the contributions for editing and updating their papers to make them suitable for publication. We would also like to take the opportunity to thank the publishers of *FGCS* for providing the platform to present these challenging new developments in massively parallel computing.

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