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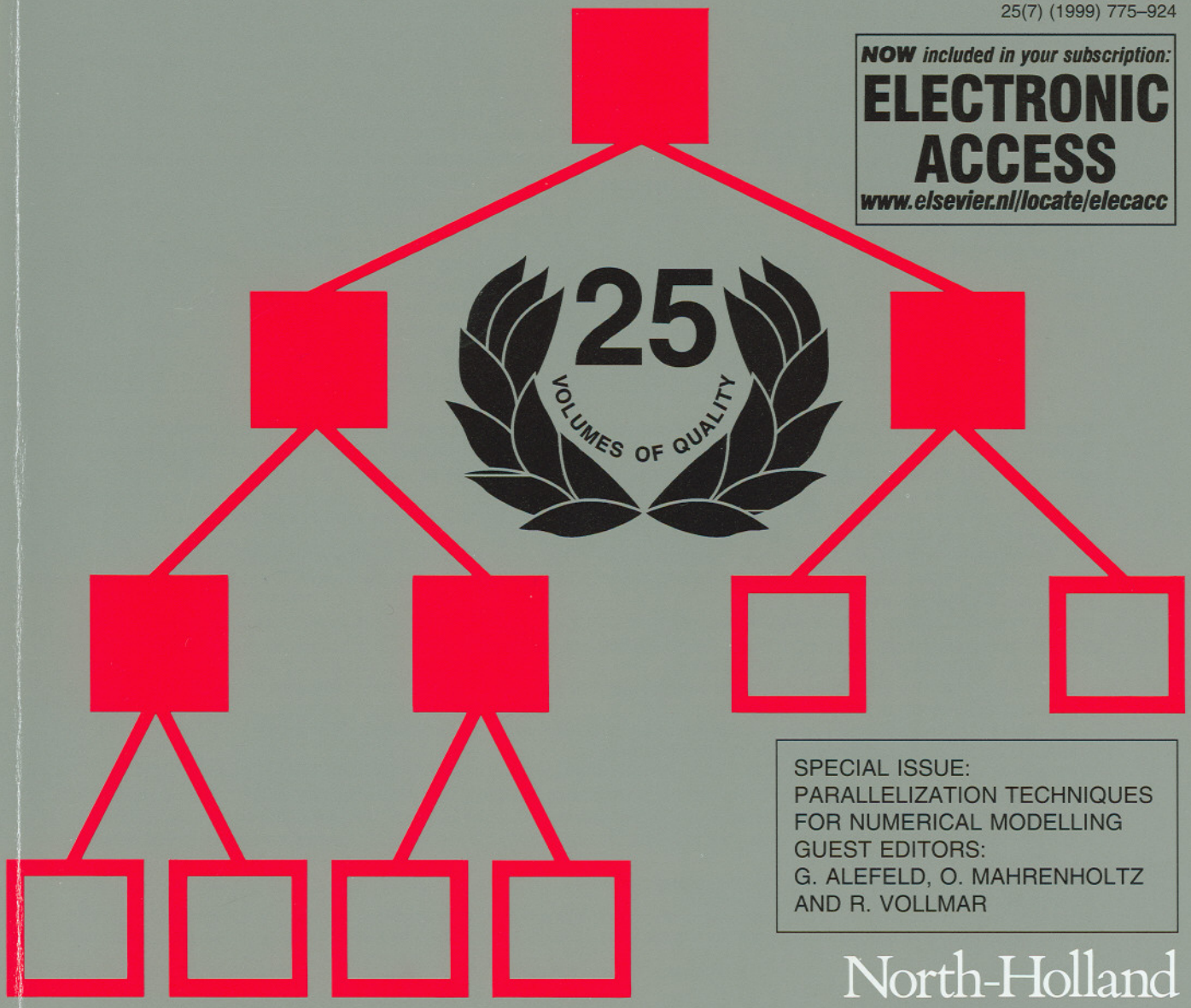

SPECIAL ISSUE:
PARALLELIZATION TECHNIQUES
FOR NUMERICAL MODELLING
GUEST EDITORS:
G. ALEFELD, O. MAHRENHOLTZ
AND R. VOLLMAR

North-Holland

Parallel Computing

Editorial policy. *Parallel Computing* is an international journal presenting the theory and use of parallel computer systems, including vector, pipeline, array, fifth and future generation computers and neural computers. Within this context the journal covers all aspects of high-speed computing.
Its primary objectives are:
– publication of new research results pertaining to the development and application of parallel computer systems;
– dissemination of information on new developments and events in this field.
The editorial policy and the technical content of the journal are the responsibility of the Editors and the Editorial board. The journal is self-supporting from subscription income and contains a minimum amount of advertisements. Advertisements are subject to the prior approval of the Editors.
Scope. *Parallel Computing* features original research work, tutorial and review articles as well as accounts on practical experience with and techniques for the use of parallel computers. Contributions can cover:
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– the impact of high-speed computation on current research, as well as the advancement of knowledge;
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– taxonomy, models and architecturals trends of parallel processing;
– general hardware (architecture) concepts, new technologies enabling the realisation of such new concepts as well as details of commercially available systems;
– performance measurement results on state-of-the-art systems;
– peripheral devices for parallel (super-) computers.

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Special issue: Parallelization techniques for numerical modelling
Guest editors: G. Alefeld, O. Mahrenholtz and R. Vollmar

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PARALLEL COMPUTING

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Guest editorial

Parallelization techniques for numerical modelling

This volume contains a selection of papers which were presented during a Dagstuhl Seminar in the Internationales Begegnungs-und Forschungszentrum für Informatik at Dagstuhl Castle. The title of the Seminar was "Parallel Processing in the Engineering Sciences – Methods and Applications". Parallel computers are meanwhile a generally accepted tool in all parts of applied scientific research. Unfortunately the speed up of algorithms is in practice often not as huge as theoretically awaited.

The intention of the seminar was to bring together scientists from the field of Numerical Analysis, Computer Science, Engineering and Natural Science, respectively, in order to discuss the state of the art and future developments of parallel processing in the applied sciences. The meeting provided a forum of exchange between these different research fields.

In 24 talks various parallel algorithms for different computer architectures and parallel software for mathematical modeling of real life problems were presented.

Due to the variety of attacked problems and to the many different existing parallel computers no uniform methodology has evolved during the last years. Therefore different methods have to be used for concrete problems. This will also be demonstrated by nearly all the papers of this volume.

For example, in contrast to standard finite element methods, the recursive substructuring technique assembles the element matrices recursively in several levels. For automated parallelization the method is using functional programming. Adaptivity requires dynamic load balancing.

Adaptivity of multigrid methods for partial differential equations can be attached by the concept of hash-table storage techniques.

The efficient eigenvalue and singular value computation on shared memory machines is described by two different techniques depending on the information that is required.

Nonlinear problems from structural finite element analysis usually are tackled with Newton-like methods. For a parallel implementation domain decomposition methods are used.

Hyper-systolic algorithms represent a new class of parallel computing structures. Their application to N-body computations and distributed matrix multiplication is discussed.

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In the dynamic analysis of structures using finite element methods very often prohibitively many degrees of freedom are required to model the structure sufficiently accurate. General masters are used in parallel condensation of eigenvalue problems for treating this subject.

For positron emission tomography images a systolic implementation of the maximum-likelihood expectation-maximum algorithm is discussed.

This issue contains in alphabetic order the papers which are (with one exception) concentrated on parallel processing with special emphasis on numerical methods. All papers were refereed anonymously. The editors are grateful to the referees for their very valuable support.

The organizers express their thanks to the administration and to the staff of Dagstuhl Castle for the pleasant atmosphere and to the contributors to this issue. They also thank Professor Joubert and Dr. Rönsch for publishing the articles in "Parallel Computing".

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O. Mahrenholtz, *Hamburg*
R. Vollmar, *Karlsruhe*