Guest editorial

Combining the power of high speed computer systems and efficient algorithms

In the last decades, the increase in speed of electronic computers has been tremendous, a factor of 10^7 has been realized. The advance in computer technology, such as processor speed, parallel and distributed technologies, has enabled us to simulate and study real world problems, with increasing details and complexity. However, despite the increased raw computing power, there are still many applications demanding more higher computing speed than the fastest supercomputers currently can provide. In parallel with the development of high performance computer hardware, the development of efficient solution algorithms has led to significant reduction in solution time. An example of them is the class of the so-called hierarchical algorithms: multigrid, multilevel, Barnes–Hut and Fast Multipole Method, etc. For some challenging computational problems, the use of efficient algorithms have reduced the computing time by a factor of 10^8. This means that the combination of efficient algorithms and parallel and distributed computer technology is the key to achieve high performance.

At the conference HPCN Europe 1999, a workshop on High Performance Numerical Methods and Applications has been held. The workshop brings computer scientists, applied mathematicians and engineers together to discuss results, experience and work in progress in parallel numerical methods for large-scale scientific and engineering applications. This special issue contains a number of extended version of the papers presented in the workshop, together with several papers from the session Computational Science. This special issue include papers varying from discretization methods and parallel solution algorithms for CFD applications, issues in the parallel and distributed solution of sparse linear systems, the particle and lattice-Boltzmann simulations, to applications of adaptive wavelet analysis and registration of brain images.

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