Algorithms and Programming Tools for Next-Generation High-Performance Scientific Software HPSS 2011

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The workshop *Algorithms and Programming Tools for Next-Generation High-Performance Scientific Software* (HPSS) focuses on recent advances in algorithms and programming tools development for next-generation high-performance scientific software as enabling technologies for new insights into Computational Science.

Scientific Software is a key component in developing effective instruments for Computational Science. Prototyping and developing scientific codes in terms of reliable, efficient and portable building blocks allow users to reduce the time-to-solution of a computational problem and to simplify the inclusion and comparison of new physical/mathematical models and solvers. The history of open-source high-performance scientific libraries and frameworks, such as ScaLapack, FFTW, PETSc, Trilinos, ATLAS, only to cite some of the most widely used, is a history of success. Some of the mentioned packages represent both "de facto" standard platforms for scientific code development and benchmarks for new proposals of hardware/software architectures devoted to high-performance computing. On the other hand, we are currently living a discontinuity in software design procedures due to the need of efficient use of near future highly parallel machines, where multiple levels of parallelism and heterogeneous components will be integrated. Relevant changes are happening from programming models to base software, thus scientific software community is thinking and working on new challenges of tomorrow's scientific software infrastructure for Computational Science. Designing and implementing high-quality, reusable, extensible and portable scientific software require inputs and skills from different areas of Mathematics and Computer Science. Many issues have to be considered, such as targeting theoretical efficiency when designing new algorithms, being at the same time aware of architectural limitations; analyzing performance of such algorithms on emerging computers by realistic performance models as well as by practical implementation; using advanced programming tools for simplicity of usage and portability of the resulting software.

HPSS is intended to bring together applied mathematicians, computer scientists and computational scientists from different areas, in order to discuss recent challenges and results in modern technology issues for high-performance comput-

ing as well as in developing open-source high-quality software for Computational Science.

The contributions of the authors certainly work togheter to reach this aim and are representative of outstanding research in the context of design and development of algorithms and software for high-performance scientific computing. We want to thank all the authors for having submitted papers to HPSS 2011.

Our gratitude also goes to Iain Duff and Laura Grigori for accepting our invitation to give a lecture.

In this book are collected 11 contributed papers selected among 21 submissions by a peer review process. Moreover, we are very grateful to Iain Duff for allowing us to include his paper in the book. The paper focuses on the European Exascale Software Initiative, a recent project funded by European Community, which had the final aim to build a european vision and roadmap to address the challenges of the new generation of parallel systems providing exaflop performance in the near future.

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