DTU Compute
Department of Applied Mathematics and Computer Science

# Seminar on Modern Scientific Computing Trends

We invite all those interesting in modern scientific computing trends to a free 2-hours seminar.

## December 5, 2013 · 13:00–15:00 · Building 101, Meeting Room 2.

**Advanced Multigrid Solvers**
Sparse linear solvers play a large role in many computational simulations in the physical and data sciences, and often contribute to a large portion of the total simulation time. As the complexity of applications continues to grow, so do the demand on these sparse solvers. The matrix problems are no longer driven by elliptic problems, the structure is often not predictable, and algebraic systems that are non-symmetric and complex are more commonplace. Thus, more robust and general solver techniques are needed in order to maintain pace with the growing demand. Algebraic multigrid methods (AMG) provide a flexible framework for developing such methods, yet traditional approaches are not robust and need redesign for a wider range of problems. In this talk, we give an overview of AMG, some extensions of the methodology toward a more general setting, and highlight the state of current AMG development. In addition, well comment on how new multigrid methods are able to scale to large computing architectures and take advantage of high-throughput computing elements.

**Adopting heterogeneous hardware platforms for scientific computing**
Lately, CPUs have received competition from non-conventional hardware for carrying out computational work. General-purpose GPUs and Intel's Xeon Phi coprocessors are now widely used in cutting-edge supercomputers. However, such heterogeneous hardware platforms raise higher demands on the users. For example, GPUs require specific implementations, such as those provided by CUDA or OpenCL programming. The newly arrived Xeon Phi coprocessors had a promise of seamless code portability, but the reality is challenging for programmers who want to achieve good performance portability. This talk will thus discuss some experiences with heterogeneous computing, with real-world applications from computational geoscience and biology.

## Program

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| 12:45 – 13:00 | Coffee and tea. |
| 13:00 – 13:05 | Welcome and introduction by Assoc. Prof. Allan P. Engsig-Karup, DTU Compute. |
| 13:05 – 13:50 | *Advanced Multigrid Solvers*<br>By Assoc. Prof. Luke Olson, Department of Computer Science University of Illinois at Urbana-Champaign, USA. |
| 13:55 – 14:40 | *Adopting heterogeneous hardware platforms for scientific computing*<br>By Prof. Xing Cai, Simula, Norway. |
| 14:40 – 15:00 | Refreshments and networking |

**About GPU-Lab**
GPULab at DTU Compute has since 2008 been established as competence center and hardware facility associated with our research in parallel algorithms and heterogenous parallel programming paradigms for many-core hardware accelerators. We develop efficient, parallel and scalable algorithms for simulation, optimization and imaging on this facility, and during this process we create software libraries and we develop methodologies needed for writing efficient accelerated code. Learn more at `http://gpulab.imm.dtu.dk`.

**Registration.** Please register by sending **before December 1** an e-mail to Assoc. Prof. Allan P. Engsig-Karup (apek@dtu.dk), Section for Scientific Computing, Department of Informatics and Mathematical Modelling, DTU.