PhD Course Description

We offer a two day PhD course/workshop on "How To Scale Scientific Applications from Laptops to Supercomputers with PETSc?"

The PhD course is offered as a part of activities and with support from the DTU Compute Graduate School (ITMAN) and the Danish Center for Applied Mathematics and Mechanics (DCAMM) at Technical University of Denmark, see www.dcamm.dk.

PhD Course objective

The aim of the course is to introduce the participants to the PETSc framework for writing scalable scientific applications, and participants will learn about the best practices and gain hands-on experience on how PETSc can help you find fast solvers. Next to this, participants will

- ✓ get a better understanding of how linear and nonlinear solvers work and how they can be accelerated,
- ✓ see how physical properties such as diffusion can be leveraged for the design of faster solvers,
- ✓ run solvers on parallel machines and scale them from a single process to hundreds of processes.
- ✓ learn efficient workflows with debugging and profiling tools inside and outside of PETSc.

PhD Course Homepage

http://www2.compute.dtu.dk/~apek/Workshop2016/

Organizers and Lecturers

Freelance Computational Scientist Karl Rupp

Associate Professor Allan P. Engsig-Karup
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Technical University of Denmark.
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Associate Professor Niels Aage
DTU Mechanics
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Participants

The course is intended for PhD students, PostDocs and MSc students with a fundamental knowledge of numerical analysis and linear algebra and must be able to program. It is recommended to read the PETSc user manual before participating in the course. It will be possible to use PETSc through the gbar datasystem if it is not installed on participants own laptops.

Work Load

Approximately 16 scheduled hours (lectures, discussions and computer exercises) during the course and approximately 40 hours for the completion of an assignment problem after the duration of the workshop. Also, to prepare for the course it is required that participants read the literature proposed below in advance.

Literature

PETSc user manual (with installation instructions)
http://www.mcs.anl.gov/petsc/documentation/index.html

Language

All lectures will be given in English.

Registration

Sign up by sending an E-mail to one of the DTU organizers.

Registration Fee

There is no registration fee for students enrolled at universities and public research institutions. For researchers employed at universities and public research institutions the registration fee is €500. For all other participants the registration fee is €1500. Payment information will be given upon signing up for the workshop.

Deadline

The submitted request for registration must be received by the course secretariat no later than **February 26th, 2016.** Information on enrollment will be posted within a week after this date. Signup is on a first-come first-serve due to limited seats.

PhD Course (optional)

A PhD special course titled "PhD course on using PETSc for solving PDEs and optimization problems" may be offered following the workshop to get hands-on experience working independently with PETSc. If this is desired participants needs to make an agreement with one of the DTU Advisors during the participation at the workshop.

Evaluation and Diplomas

To pass the course, active participation and the satisfactory completion of an assignment problem after the duration of the course are required. ETCS points: 2.5 (equivalent to 1.5 week effective full time work).

Course Contents

The following topics will be covered in the course
1. Setting up a system of equations (numerical problem) to be solved in PETSc.
2. Solving the systems of equations using linear or nonlinear solvers from PETSc.
3. Benchmarking of the solvers used in numerical experiments.
4. Discussion of methods and results in the context of the numerical problem.

Talk to the DTU advisors for more details.

Lunch

The ITMAN and DCAMM schools are sponsoring a daily lunch for participants that are enrolled at universities and public research institutions.

Housing

Accommodation in hostels/hotels can also be arranged by the participants themselves, see e.g. the Wonderful Copenhagen website at www.woco.dk and course webpage.

Internet Resources

For facts on the Technical University of Denmark and visitors' information: See http://www.dtu.dk. Information about teaching and research at DTU Compute can be found at http://www.compute.dtu.dk, and for DCAMM at http://www.dcamm.dk.

About ITMAN

The DTU Compute Graduate School ITMAN (IT MAN) administers the PhD program at DTU Compute. ITMAN promotes cross-disciplinary research, matching information technology and mathematical modelling with other disciplines, often in collaboration with external collaborators: Other research institutions and private companies.

ITMAN is based on the idea of optimizing the relationship man - knowledge - IT as a key to growth for Danish companies in the global innovation and productivity competition. If one is to understand the role of IT, it is essential to view IT as more than "computers and software": IT is always a factor in the intricate net of machine, man and market.

ITMAN aims to strengthen research education through a series of initiatives: Specialized PhD courses and summer schools, quality assurance of supervision, PhD processes and procedures, research environment, implementation of a mentor program, help with IPR, social activities, etc.

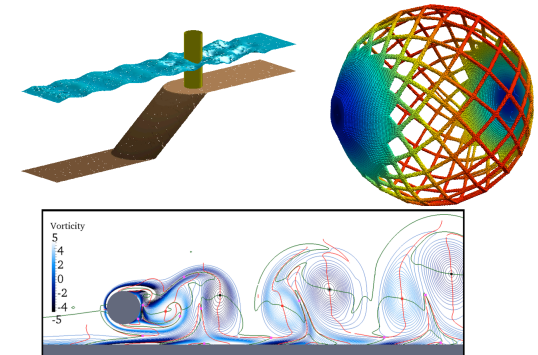### DANISH CENTER FOR APPLIED MATHEMATICS AND MECHANICS

The Danish Centre for Applied Mathematics and Mechanics, DCAMM, is an informal framework for internationally oriented scientific collaboration between staff members at a number of departments at the Technical University of Denmark (DTU), Aalborg University (AAU), Aarhus University (AU) and University of Southern Denmark (SDU). The Departments cooperating within DCAMM are:

- Dept. of Applied Mathematics and Computer Science, DTU
- Dept. of Civil Engineering, DTU
- Dept. of Mechanical Engineering, DTU
- Dept. of Wind Energy, DTU
- Dept. of Civil Engineering, AAU
- Dept. of Mechanical and Manufacturing Engineering, AAU
- Dept. of Engineering, AU
- Dept. of Mathematics and Computer Science, SDU
- Dept. of Technology and Innovation, SDU

DCAMM is an informal construction that was founded October 27, 1969. The day to day activities are coordinated by the chairman of the Center (pt. Associate Professor Niels Leergaard Pedersen Department of Mechanical Engineering, Solid Mechanics), while the formal governing body of DCAMM is the Scientific Council.

The Technical University of Denmark
DTU Compute & DTU Mechanics

Section for Scientific Computing
TopOpt Group
&
DTU Compute Graduate School (ITMAN)

Workshop

How To Scale Scientific Applications from Laptops to Supercomputers with PETSc?

Kgs. Lyngby, Denmark
March 2nd to March 3rd, 2016

DTU Compute
Department of Applied Mathematics and Computer Science

DTU Mekanik
Institut for Mekanisk Teknologi