Course Objectives

Ph.D. School in Scientific GPU Computing
As part of the Ph.D. schools ITMAN and DCAMM, DTU Informatics hosts this summer school about utilizing massively parallel processors (GPUs) for desktop scientific computing. Speakers from NVIDIA will talk about latest hardware development, how to program GPUs using CUDA, and how to get the best performance. Speakers from academia will talk about numerics, parallel linear algebra, PDE solvers, and other scientific computing applications of the GPU.

Learning Objectives

A student who has met the objectives of the course will be able to:

- Write CUDA programs.
- Use CUDA numerics libraries (CUBLAS and CUFFT).
- Parallelize dense and sparse linear algebra computations.
- Discretize and parallelize PDE solvers.
- Solve scientific problems using the GPU.
- Estimate accuracy vs. speed-up of numeric algorithms running on GPUs.

Language

All lectures will be given in English.

Organizers

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This course is offered as part of the activities of the DCAMM International Graduate Research School.

Course lecturers

- Prof. Dr.-Ing. Hendrik Lensch, Institute of Media Informatics, Ulm University.
- Dr. Robert Strzodka, Integrative Scientific Computing Group, Max Planck Institut Informatik.
- Timothy Lanfear, NVIDIA Corporation.

Internet resources

For information about teaching and research at the DCAMM departments: see http://www.dcamm.dk.
For facts on the Technical University of Denmark and visitor's information see: http://www.dtu.dk.
For information on the University of Aalborg see: http://www.aau.dk.

Participants

The course is designed for Ph.D. students and other graduate students at Master's level.

Work Load

Each day (Wednesday-Friday) there will be lectures 9-17. Wednesday and Thursday there will be lab exercises in the evening. These two days dinner is included.

Study Material

Kirk, Hwu. Programming Massively Parallel Processors: A Hands-on Approach. Morgan Kaufmann, 2010.

Evaluation and Diplomas

To pass the course, active participation in all activities is required, as well as electronic submission of reports in the following two weeks.
Grades: Pass/Fail. ECTS points: 2.5 (or 5 if follow-up project is also completed).

Registration:

Ask for a registration form from the DCAMM-course Secretariat, attn.: Kari Haugland, Department of Mathematics, Technical University of Denmark, Building 303S, DK-2800 Lyngby, Denmark. Tel.: (+45) 45253031, Fax: (+45) 45881399, E-mail: dcamm@mat.dtu.dk.

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 250 EURO. This covers hand-outs, coffee and social events. For all other participants the registration fee is 750 EURO.

Deadline:

Applicants should submit their registration to the course secretariat no later than 14 May, 2010. You will receive confirmation within a week after this date.

Housing:

There are a limited amount of rooms available on the premises of the Technical University of Denmark (DTU). These will be offered free of charge to students and otherwise at a cost of 25 EURO per night. Accommodation in hostels/hotels can also be arranged by the participants themselves, see the Wonderful Copenhagen website at www.woco.dk.

Scholarships:

For Ph.D.-students enrolled at non-Danish universities and research institutions outside the EU, we can offer a limited number of scholarships in order to facilitate participation, covering lodging (see above) and extra living costs with a per diem amount of 25 EURO. Travel expenses will not be covered. Your CV and a short letter of recommendation from your Ph.D.-supervisor should then be sent in together with the application form.

Cover illustration:

- Top: Diffusion example – multiscale flow visualization. Image courtesy of Tobias Preusser. http://www.mevis-research.de/~tp/FlowVis/index.html
- Middle: PDE example – fluid dynamics. Image courtesy of Mark Harris, NVIDIA.
- Bottom: Development in peak performance of NVIDIA commodity GPUs.

The **Danish Center 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) and Aalborg University (AAU). The departments cooperating within DCAMM are:

- Dept. of Informatics & Mathematical Modelling, DTU
- Dept. of Mathematics, DTU
- Dept. of Mechanical Engineering, DTU
- Dept. of Civil Engineering, AAU
- Dept. of Mechanical Engineering, AAU

DCAMM is an informal construction. The day to day activities are coordinated by the secretary of the Center, while the formal governing body of DCAMM is the Scientific Council.

The **DCAMM International Graduate Research School** functions within the standard framework of the Ph.D. education at the Technical University of Denmark (DTU) and at Aalborg University (AAU). Ph.D.-students associated to the School are full members of DCAMM through their departments and are enrolled in relevant Ph.D.-programmes at DTU and AAU.

The School's role is to provide for an interdisciplinary framework for education of young researchers in an international research environment, and the activities are supported by Danish Agency for Research, Technology and Innovation (FUU).

DANISH CENTER FOR APPLIED MATHEMATICS AND MECHANICS

Ph.D.-course

Scientific GPU Computing

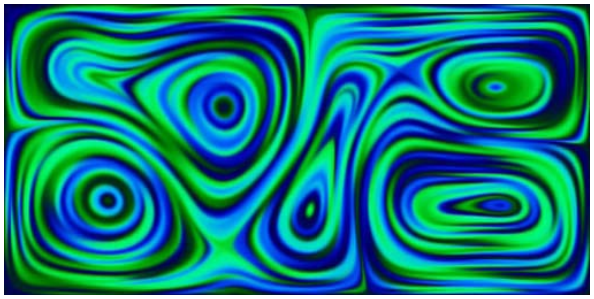
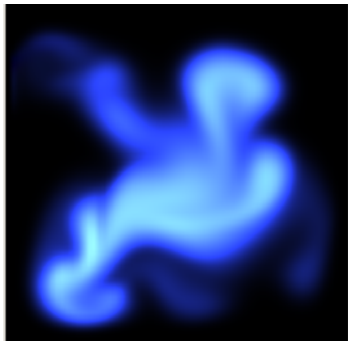
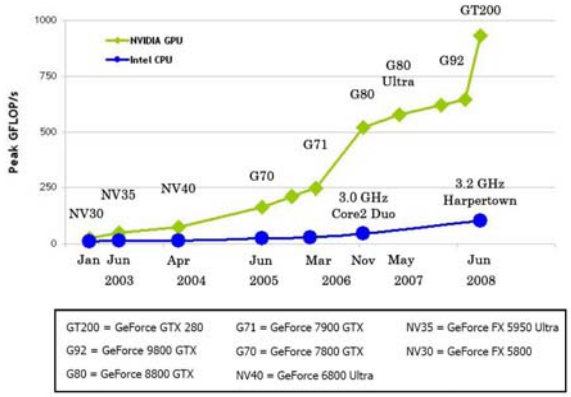
at

Technical University of Denmark,
Lyngby, Denmark

26th to 28th May, 2010

Organized by:
Department of Informatics and Mathematical Modelling,
Technical University of Denmark

Technical University of Denmark
University of Aalborg

DTU

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