FDD3260 High-performance Computing for Computational Scientists 5.0 credits

Högpresterande beräkningar för beräkningsforskare

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FDD3260 valid from Spring 2023

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

Basic knowledge of Linux commands, C/C++ or Fortran languages is required.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

By the end of this course, students will be able to:

- Describe the architecture of modern supercomputers and the different computing units, including multi-core processors, Nvidia GPUs, and AMD GPUs.
- List the sustainability aspects of HPC and its impact on the environment and society.
- Use programming models for shared-memory (OpenMP) and distributed-memory (MPI) programming to develop scientific applications for supercomputers.
- List the fundamental principles of programming Nvidia and AMD GPUs and develop efficient GPU-accelerated applications.
- Apply software engineering principles to develop scientific applications for supercomputers.
- Use performance monitoring tools to identify performance bottlenecks and optimize supercomputer application performance.
- Apply high-performance data analysis and visualization techniques to scientific applications.
- Practice programming on the PDC HPC supercomputers and apply the learned concepts to real-world problems.

Course contents

The course focuses on six topics:

1 - computer architecture: multi-core processor, memory, and high-performance network;

2 - programming models: shared-memory and distributed-memory programming;

3 - applied GPU programming: Nvidia GPU and AMD GPU;

4 - performance profiling and analysis with tools;

5 - high-performance data analysis and visualization;

6 - sustainability in computing.

Examination

- EXA1 - Examination, 5.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

EXA1 - Examination, 5.0 credits, grading scale: P, F

The final five credits are awarded for completing in-class exercises and a final test covering the material presented in the course.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.