Programming of Parallel Computers - Methods and Tools

Programme course

6 credits

Programmering av parallelldatorer - metoder och verktyg

TDDC78

Valid from: 2017 Spring semester

Determined by
Board of Studies for Computer Science and Media Technology

Date determined
2017-01-25

Main field of study
Computer Science and Engineering, Computer Science

Course level
Second cycle

Advancement level
A1X

Course offered for
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Media Technology and Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Computer Science, Master's programme
- Electronics Engineering, Master's programme
- Mathematics, Master's programme
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Basic course in programming. A course in process programming is useful but not required, since understanding the process concept is assumed. Programming skills in C/C++ are required.

Intended learning outcomes

Parallel computers are used for heavy computations.
The student should acquire knowledge about the programming of parallel computers and master selected methods and tools.
The course shall also give an overview of how parallel computers can be used in some application areas, such as image analysis and scientific computations.
After the course the student is expected to be able to 1) use efficient methods and languages for the programming of parallel computers, 2) program parallel computers with distributed memory (MPI) and shared memory (OpenMP).

Course content

Parallel computer architecture: memory hierarchies, shared memory and distributed memory architectures. Vector instructions. Parallel execution models and programming languages. Performance measurements and enhancement. Message passing, multithreaded and dataparallel programming. Principles of dataparallel languages. Time complexity. Scalability. Scheduling of parallel programs. Grid computing. Tools for parallel programming. MPI (Message passing interface), HPF (High Performance Fortran) and OpenMP. Basic parallel algorithms and BLAS (Basic Linear Algebra Subprograms). Application areas. Parallel solving of equation systems. The laboratory course gives practical experience in programming parallel systems (different programming paradigms are used).

Teaching and working methods

The lectures deal with theory and principles, and the laboratory course gives practical exercise in parallel programming and the use of support systems.
The lab course uses parallel supercomputer resources located at the National Supercomputer Center.

Examination

LAB1	Laboratory work	3 credits	U, G
TEN1	Written examination	3 credits	U, 3, 4, 5

The questions in the written exam check how well the student has fulfilled the learning goals of the course. For passing the exam, deficits in fulfilling certain partial goals can be balanced by a better fulfilling of other partial goals.

Grades

Alternative-grade scale, LiU, U, 3, 4, 5

Other information

Supplementary courses:
Multicore and GPU Programming.

Department

Institutionen för datavetenskap

Director of Studies or equivalent

Ahmed Rezine

Examiner

Christoph W. Kessler

Course website and other links

http://www.ida.liu.se/~TDDC78/

Education components

Preliminary scheduled hours: 52 h
Recommended self-study hours: 108 h

Course literature

C. Kessler: Programming of parallel computers - Compendium OHs, finns tillgänglig för registrerade kursdeltagare på kurshemsidan. L. Elden, H. Park and Y. Saad. Scientific Computing on High Performance Computers (compendium), finns tillgänglig för registrerade kursdeltagare på kurshemsidan. Labb-kompendium, finns på kurshemsidan. För ytterligare kurslitteratur se kursens hemsida.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.