

High-performance computing

ME 343, CS 343, PHYS 343

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Description: Theory and application of parallel programming techniques to large-scale scientific and engineering computational problems.

Course Content:

1. Overview of computational hardware. The section of the course will focus on the performance of different processors, motherboards, networking and storage. How can serial codes be adjusted to leverage the inherent capabilities of existing hardware architectures.
2. Introduction to parallel programming focused on MPI. We discuss performance metrics and limits followed by the inherent parallelization of different types of engineering and scientific problems. The design of MPI including the implementation on ACCRE's cluster will be discussed. The essential elements of a parallel program will be illustrated via several examples developed in class and as programming homework assignments.
3. Architectures, program designs and advanced technologies for performance enhancement. The theory of advanced network architectures and their relationship to specific types of programming tasks will be followed by novel processor designs (graphics chips and cell processors) and novel software middleware.

The course grade will be determined by a student's performance on several programming assignments and a class project. The topic of the project is expected to be related to the student's thesis work, and should be discussed with the instructors.

Prerequisites: While no formal prerequisites exist, students are expected to demonstrate a nominal understanding of programming computers using a compiled language. C/C++ or Fortran experience is recommended. In addition, experience with a unix-like operating system will be extremely helpful. An excellent way to obtain this experience easily is to attend the ACCRE Training sessions. In fact, these should be considered an informal prerequisite for the high-performance computing course. If you have any doubts about your skill level, please discuss your situation with one of the instructors.