High Performance Scientific Computing

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Course Content

1. Introduction to high performance computing and scientific computing. The need for HPSC.
2. Processor performance. Memory hierarchy. Multi-core processing and Vector computing
3. Introduction to parallel programming concepts and parallel algorithms
4. Effective use of command line Linux. Bash scripting
5. Use of version control systems such as Git/SVN/Mercurial.
6. Introduction to OpenMP and thread programming , MPI programming, GPGPU / Vector programming
7. Effective use of debuggers and parallel debugging
8. Performance analysis of parallel programming
9. Application of parallel programming techniques to numerical methods.
10. Use of toolkits such as BLAS, LAPACK, PETSC etc.
11. Advanced scientific visualization.

Prerequisites

- Basic programming skills in some programming language.
- Skills such as editing a program, using basic programming structures like loops, if–then–else, file handling.
- Basics of numerical methods and linear algebra. Basic matrix operations.
- Will be essential to get comfortable with Linux / Unix environments.
- Computer requirement: A computer with Linux (or Unix) installed. Alternatively use VirtualBox to have a Virtual installation of Linux, if you find Windoze so dear!
- Finally!, immense patience and willingness to get hands dirty in computing.