HPC, Matrix Computations and Large Sparse Systems

ECTS
4 crédits

Hourly volume
59h

Introducing

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):
Eigenproblems :
- Different eigenproblems, their conditioning and Schur¿s factorization,
- Different methods for eigenvalue problems : power method, orthogonal iterations, QR method and Krylov subspace methods.

HPC :
This module is focused on the presentation of the basic mechanisms used to achieve high performance on modern computers. The language used by the students will be Python/C with which they¿ll learn to implement some MPI. They will also learn to program some Krylov¿s solvers as well as the LU factorization and to efficiently solve Poisson¿s equation discretized with finite differences.

Sparse systems :
- Principle and some strategies for sparse storages,
- Principle of different projection techniques to define iterative methods for solving sparse linear systems,
- Principle of different preconditioning techniques
- Principle of some reordering techniques to solve sparse linear systems with direct methods.

The student will be able to:
Eigenproblems :
Understand the difficulties of a problem, and choose a method.
Paradigms and langages :
At the end of this module, students will be able to develop and to maintain Python / C software codes, to analyze applications performances and to supplement them with MPI/OpenMP directives in order to enable a parallel execution.

Sparse systems :
Chose one or a few methods adapted to a given linear system.

Necessary prerequisites

- Precedent courses on the following subjects : linear algebra, numerical analysis.
- Knowledge of the imperative programmation language main concepts (Python and C).

Practical info

Location(s)

Toulouse