Partial Derivative Equations 1

Introducing

Description

Modeling with PDE (linear PDEs in one dimension space)
1. Transport and wave equation
2. Heat equation
3. Schrödinger¿s equation,¿

Exact resolution of PDE in one dimension space
1. Characteristic method (transport, wave)
2. Variable separation (heat, wave, Schrödinger,¿), use of the linearity (superposition principle) and link with Fourier series
3. Fourier transform
4. Dissipative and dispersive phenomenon

Finie Difference Method in one dimension space
3. Consistancy, order, stability, scheme convergence
4. Courant-Friedrichs-Levy condition (CFL)

Objectives

At the end of this module, the student will have understood and be able to explain (main concepts):

• Classical linear one dimensional PDE (heat, transport, wave...), their exact resolution and the qualitative behavior of their solutions
• The Finite Difference method in one dimension space to solve PDE

The student will be able to:
• Solve linear PDE in one dimension space (characteristic method, variable splitting, superposition principle, Fourier transform)
• Implement Finite Difference method in one dimension space, coupled with numerical solving method for ODE in order to solve PDE.

Necessary prerequisites

Linear Algebra: matrix manipulation, eigenvalues and eigenelements, solving of linear differential equations.

Ordinary differential equations: modeling, existence of solutions, qualitative study, numerical simulation (convergence, stability, order)

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

Toulouse