

MASTER PHYSIQUE

PARCOURS PHYSIQUE OCÉAN ET CLIMAT

semestre 7 Physique POC

Modélisation numérique 1

Présentation

This course introduces the basic numerical methods used to solve fluid mechanics problems (finite differences, spatial discretization, integration in time, accuracy, order, convergence, stability). The course is taught in English. Practicing is an essential part of the course. The programming language is Python.

4 crédits ECTS

Volume horaire

Cours Magistral : 9h

Travaux Dirigés : 21h

Objectifs

Objectives

Acquire the foundation concepts of numerical modelling. Be able to implement numerical methods in Python. Be able to test and validate a numerical code.

Pré-requis nécessaires

Pre-requisites

Linear algebra, ordinary differential equations

Compétences visées

Abilities provided

Identify numerical methods for problem solving and validate results ; know and know how to use numerical simulation codes to tackle complex problems

Descriptif

Contents

Classes are done in computer rooms, they blend theory and practice with a computer. Small homework are asked from one class to another. The final mark is composed of a final exam (50 % of the mark), in computer room, and of two personal projects (25% each). The course is split in two parts

Part 1: Spatial discretization

- > finite vs volume methods
- > staggered grid
- > boundary conditions
- > matrix representation
- > eigenvectors and eigenvalues
- > iterative methods to solve system of equations

Part 2: Integration of ordinary differential equations

- > order, convergence, stability
- > explicit vs implicit schemes
- > Runga Kutta methods
- > multi-stages methods

Modalités de contrôle des connaissances

Session 1 ou session unique - Contrôle de connaissances

| Nature de l'enseignement | Modalité | Nature | Durée (min.) | Coefficient | Remarques |
|--------------------------|----------|--------------------------|--------------|-------------|-----------|
| | CT | Ecrit - devoir surveillé | 180 | 50% | |
| | CC | Ecrit - devoir maison | | 50% | |

Session 2 : Contrôle de connaissances

| Nature de l'enseignement | Modalité | Nature | Durée (min.) | Coefficient | Remarques |
|--------------------------|----------|--------|--------------|-------------|-----------|
| | CT | Oral | 30 | 100% | |