Computational Plasma Physics

Academic Year: (2022 / 2023) **Review date: 14-06-2022**

Department assigned to the subject: Physics Department

Coordinating teacher: SANCHEZ FERNANDEZ, LUIS RAUL

Type: Electives ECTS Credits : 6.0

Year : 2 Semester : 1

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Plasma Physics. Computational Physics.

OBJECTIVES

- Reach an advanced level of proficiency in the use of basic simulation algorithms (finite differences, Monte Carlo methods, etc.)
- Reach an introductory level of knowledge on advanced simulation techniques (spectral methods, Lagrangian methods, etc.)
- Be able to simulate numerically a complex problem in plasma physics: algorithm selection, implementation, benchmarking and solution.

DESCRIPTION OF CONTENTS: PROGRAMME

Part I: Analysis of time series
I.1 Linear Analysis: Correlation functions, Fourier analysis, Wavelets analysis
I.2 Nonlinear Analysis: bi-coherence, bi-spectral analysis, multifractal analysis.

Part II: Plasma Simulation
II.1 Finite differences
II.2 Finite elements
II.3 Spectral and pseudo-spectral methods
II.4 Particle methods (PIC, SPH, etc.)

Part III: Introduction to parallel programming

LEARNING ACTIVITIES AND METHODOLOGY

- Topics are discussed in class with the help of slides that are provided to students.
- Selected projects from the area of fusion plasmas are handed to the students that, in small groups, must work through them, simulate them numerically, and present them in class at the end of the course.

ASSESSMENT SYSTEM

- Problemas semanales resueltos (25%)
- Projecto numérico (75%)

% end-of-term-examination:	0
% of continuous assessment (assigments, laboratory, practicals…):	100

BASIC BIBLIOGRAPHY

- C. Canuto et al Spectral Methods in Fluid Dynamics, Springer-Verlag, 1988
- Chuen-Yen Chow Introduction to Computational Fluid Mechanics, John Wiley and Sons, 1979