UAB
Universitat Autònoma de Barcelona

High-Performance Simulation

Code: 104424
ECTS Credits: 6

2024/2025

Degree	Type	Year
2503740 Computational Mathematics and Data Analytics	OT	4

Contact

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Teachers

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although it is not a mandatory prerequisite, it is advisable to have taken the third year subjects "High performance Computing" and "Modeling and Simulation".

Objectives and Contextualisation

This subject aims to introduce students to simulation techniques used in multidisciplinary areas. Learn to use simulation tools from different areas and learn to analyze their computing needs in order to make a good choice of the execution environment.

Learning Outcomes

1. CM47 (Competence) Implement high-performance computing libraries.
2. CM47 (Competence) Implement high-performance computing libraries.
3. CM48 (Competence) Adapt the execution of the simulation to the dimensions of the features.
4. CM48 (Competence) Adapt the execution of the simulation to the dimensions of the features.
5. KM37 (Knowledge) Describe the different components of a system and the interactions between these.
6. KM38 (Knowledge) Identify the parameters determining the optimum functioning of a system.
7. SM47 (Skill) Model complex systems considering computational aspects.

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Content

Theme 0.- Introduction to High Performance Simulation.

Theme 1.- Non-coupled simulations:

- Forest Fire spread simulators.

- Wind field simulators.

- Atmosphere evolution simulations (weather forecast)

Theme 2.- Coupled simulations:

- Coupling atmosphere and chemistry to assess air quality

- Coupling urban models to assess air quality in cities.

- Coupling atmosphere and forest fire spread.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Theoretical Lectures	24	0.96	
Type: Supervised			
Practical sessions	25	1	
Type: Autonomous			
Group work to develop and/or analyse the model and simulators functioning	51	2.04	
Study on models and simulators	40	1.6	

The subject is planned to be carried out in person, if for reasons beyond the programming of the subject, the teaching methodology had to be changed, and the classes would be carried out in a telepresencial way, that is, in synchronous sessions following the schedule established by the coordination of the degree

The subject will be developed in theoretical and practical classes. The distribution of the sessions throughout the semester will be available on the first day of class in the Virtual Campus of the subject.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
1.- Practical exercise of Simulation considering Non-coupled models	40	4	0.16	CM48, KM37
2.- Practical Exercises of Simulation including Coupled models	40	4	0.16	CM47, SM47
3.- Computational Performance Analysis of Simulator	20	2	0.08	KM38

The evaluation will be carried out developing and presenting the proposed case studies using the tools presented in the theoretical sessions. Group work and interaction will also be assessed.

Bibliography

WRF user's guide: https://www2.mmm.ucar.edu/wrf/users/docs/user_guide_v4/contents.html

WRF-Chem documentation: https://ruc.noaa.gov/wrf/wrf-chem/

FARSITE documentation: https://www.firelab.org/project/flammap

WindNinja documentation: https://www.firelab.org/project/windninja

Software

VirtualBox

WRF

WRF-Chem

FARSITE

WindNinja

Language list

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan	second semester	morning-mixed
(TE) Theory	1	Catalan	second semester	morning-mixed