UCLouvain

lphys1303

2022

Numerical Simulation in Physics

4.00 credits	22.5 h + 30.0 h	Q2

Teacher(s)	Ragone Francesco ;
Language :	French > English-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	It is recommended that students master the notions of computer science and digital methods as covered in the course LPHYS1201.
Main themes	IInitiation to numerical simulation in physics by solving partial differential equations using finite difference methods or spectral methods.
Learning outcomes	**At the end of this learning unit, the student is able to :** **a. Contribution of the teaching unit to the learning outcomes of the programme** 1.4 , 1.7, 2.1, 2.3, 2.4 3.3 4.1 5.1 6.1, 6.4 1 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to: 1. explain the importance and interest of numerical simulation methods in physics; 2. analyse the stability, convergence and accuracy of a numerical method; 3. compare alternative numerical methods for solving a differential equation; 4. design a methodology for solving a given physical problem by numerical simulation; 5. write a report on solving a physical problem by numerical simulation.
Evaluation methods	Evaluation of two written reports on the resolution of physical problems by numerical methods: (a) finite difference methods; (b) spectral methods.
Teaching methods	- Classroom lectures (using slides). - Exercises framed as small projects in computer room.
Content	1. General introduction to numerical methods 2. Finte difference methods a. Initial condition problem (ordinary differential equations) b. Boundary condition problem c. Diffusion d. Advection e. Waves 3. Spectral methods for the resolution of a. ordinary differential equations b. partial differential equations
Bibliography	- M. Holmes, Introduction to Numerical Methods in Differential Equations, Springer Texts in Applied Mathematics (52), 2007. - L. N. Trefethen, Spectral methods in Matlab, SIAM publications, Oxford, 2000. - D. Gottlieb et S. A. Orszag, Numerical analysis of spectral methods: Theory and applications, SIAM, 1986.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Minor in Physics	MINPHYS	4		
Master [120] in Physical Engineering	FYAP2M	4		
Bachelor in Physics	PHYS1BA	4		