UCLouvain

lphys1303

2021

Numerical Simulation in Physics

4.00 credits	22.5 h + 30.0 h	Q2

Teacher(s)	Crucifix Michel ;Ragone Francesco ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	LMAT1121 and LMAT1131 or equivalent teaching units from another programme. Having followed and passed LPHYS1201 is an asset. *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes	IInitiation to numerical simulation in physics by solving partial differential equations using finite difference methods or spectral methods.
Aims	**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. - - - - *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Evaluation of two written reports on the resolution of physical problems by numerical methods: (a) finite difference methods; (b) spectral methods.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** - 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	Aims
Master [120] in Physical Engineering	FYAP2M	4		
Bachelor in Physics	PHYS1BA	4	LMAT1121 AND LMAT1131	
Minor in Physics	MINPHYS	4		