UCLouvain

lepl1104

2021

Numerical methods

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	. SOMEBODY ;Legat Vincent ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	This course is intended as an introduction to techniques for carrying out numerical computation on computers. The course serves three main goals: • the understanding of basic numerical techniques with the underlying mathematical notions, • the hability to interpret the reliability of numerical results, • the programming skills to implement simple numerical algorithms with Python.
Learning outcomes	
Evaluation methods	Written examination about the theory, exercises and problems inspired from the course (90% of the final grade) - Homeworks (10%)
Teaching methods	Lectures in auditorium, supervised exercise and problem sessions, and unsupervised assignments. Real-life examples using numerical methods Use of Python software
Content	This course presents a broad overview of numerical methods, using calculus, algebra and computing science. The student must become aware of the relevant issues in selecting appropriate method and software and using them wisely, in terms of computational cost, numerical accuracy, complexity and stability. To make the presentation concrete and appealing, the programming environment PYTHON is adopted as a faithful companion. Topics include: • Error analysis: modelling error, truncation error, convergence and approximation order, floating point number representation (IEEE754). • Approximation and interpolation: Lagrange polynomials, spline functions, NURBS, orthogonal polynomials, error estimators. • Numerical integration and differentiation: backward and centered finite difference, midpoint, trapezoidal and Simpson formula, adaptive techniques. • Ordinary Differential Equations (ODE): Taylor and Runge Kutta methods, predictor-corrector methods, stability on unbounded intervals and perturbation analysis. • Linear equations: factorization methods and iterative techniques, complexity, computation of eigenvalues. • Nonlinear equations: bisection and Newton methods, optimisation applications. • Partial Differential Equations (PDE): boundary value problems (Laplace, heat equation, waves equation), approximation by finite differences.
Inline resources	https://perso.uclouvain.be/vincent.legat/teaching/epl1104.php
Faculty or entity in charge	BTCI

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Approfondissement en statistique et sciences des données	APPSTAT	5		
Bachelor in Engineering	FSA1BA	5		