Universitat Autònoma de Barcelona

2018/2019

Numerical methods

Code: 100097
ECTS Credits: 12

Degree	Type	Year	Semester
2500149 Mathematics	OB	2	2

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

As previous knowledge the students must know the basic results on continuity, derivability and integrability of real functions in one and several variables, on linear algebra and matrix calculation, and basic notions about algorithms and programming language C. These knowledges are the contents of linear algebra, real variable functions, computer tools for mathematics of the first year of the studies in mathematics, and the calculus in several variables, from the first semester of the second year.

Objectives and Contextualisation

Science and technology are supported by mathematical models of real phenomena, developed for predictive purposes. A minimum of realism gives rise to difficult resolvable models in a totally analytical way. One of the ways to study them is by calculating approximate solutions. The study of techniques (numerical methods) to obtain these approaches is the goal of the numerical analysis, this subject is an introduction. Numerical methods require a calculation effort depending on the complexity of the model and the desired precision. In accordance with the standards of today, this calculation effort forces the use of computers.

The subject's objective is double. On the one hand it has purely mathematical aspects that it shares with the other subjects of the degree. In addition, he wants to prepare the students to solve the numerical problems that they can find in their professional practice. This implies both the precise knowledge of several methods and their suitability in various situations as the dexterity in their application to the resolution of specific problems with the help of a computer.

Content

1.- Errors: Representation of real numbers. Arithmetic of floating point and formula of error propagation. Stable and unstable algorithms. Well and badly conditioned problems. (2 WEEKS)
2.- Zeros of functions: Methods of bisection, Newton and drying. Fixed point methods. Order of convergence and efficiency. Methods of Newton and Txebishev. Acceleration of convergence. Localization of polynomial roots: Rule of Descartes, Sturm method, complex roots.
3.- Polynomial interpolation: Existence and uniqueness of the interpolation polynomial of Lagrange. Calculation: Lagrange's basic polynomials, Neville algorithm, Newton's divided differences. Generalized Hermite Interpolation. Interpolation by splines.
4.- Differentiation and numerical integration: Numerical derivation. Extrapolation of Richardson. Interpolation integration formulas, Newton-Cotes closed formulas, composite rules. Romberg method.

5.- Linear systems:Triangular systems Gauss method. Pivoting strategies. Factorization. Calculation of determinants and inverse of matrices. Improperly conditioned systems. Classic iterative methods. Power method.