UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Computational Physics Laboratory

2122-3-E3001Q066

Aims

Learning the basis of scientific calculus and how to study physical problems on the computer with MATLAB

Contents

Detailed program

Part 1: Basic computational methods with MATLAB:
introduction, systems of linear equations, fixed point methods, interpolation, zeros and roots, leastsquares and optimization, numerical integration, ordinary differential equations, Fast Fourier Transform, pseudorandom numbers, eigenvalues and eigenvectors, partial differential equations.

Part 2: in depth study with applications:
Monte Carlo methods, Markov chains, random walks on graph and on the continuum, Brownian motion, importance sampling. Operator splitting symplectic methods for classical dynamics and Liouville equation. Spectral and operator-splitting methods with FFT for the Schroedinger equation.

Prerequisites

Teachings of previous years and basic knowledge of Classical and Quantum Mechanics

Teaching form

Activity in computer lab. Every lab session (teacher activity at the computer and, as far as possible, questions asked by attending and remotely connected students) will be streamed on Google Meet or analogous platform, recorded and made available to all course students.

Textbook and teaching resource

Numerical computing with MATLAB, Chris Moler, The Mathworks.

Calcolo Scientifico, Alfio Quarteroni, Fausto Saleri e Paola Gervasio, 6ª edizione, Springer.

Teacher's notes and diaries/recordings of the lab activity available on elearning.unimib.it

Semester

First and second

Assessment method

Two homeworks, one for semester; the first on textbook exercises, the second on more complex problems.

A final report on the last 5-6 lab sessions.

Oral exam with discussion on the second homework and of the final report, with overall grading of the lab activity.

Office hours

Anytime, also in video conference, after e-mail appointment.