Course offered for the PhD program
in Engineering of Modeling, Machines and Systems for energy, Environment and Transportation

Also available for students of the PhD program in Civil, Chemical and Environmental Engineering
Curriculum in Structural and Geotechnical Engineering, Mechanics and Materials
A.Y. 2023/2024 (XXXIX cycle)

(course is open for participation of students from other PhD cycles or programs)

1. Title

Numerical methods for the solution of partial differential equations

2. Course Description

Many engineering and physics applications involve solving both ordinary differential equations (ODEs) and partial derivative equations (PDEs). Although many solving software programs are available, it can occur that the solutions exhibit oscillations, numerical instabilities, or that the methods do not converge, due to the inherent complexity of the equations, particularly those at partial derivatives. It is also often unclear how to base the choice of the most appropriate type of method according to the typology of equation. The purpose of the course is to provide an overview of the main methods of solving PDEs, i.e., finite differences, finite volumes, and finite elements, providing the basis for choosing the most suitable method, the reason for lack of convergence, and the appearance of numerical instabilities, avoiding or at least mitigating their effects. The lectures are supplemented with practical solving of PDEs using Matlab and Comsol Multiphysics.

3. Course Organization

Each lesson consists of a first part of theoretical discussion followed by implementation in Matlab and/or Comsol.

4. Teacher

Patrizia Bagnerini

5. Duration and credits

25 hours (5 credits)

6. Activation mode and teaching period

The course is tentatively scheduled in one morning or afternoon per week (5 hours) for 5 weeks. In the academic year 2023/24 it will be held in the spring on dates to be determined.

7. Deadline for registration

There are no exact deadlines, those interested can write to patrizia.bagnerini@unige.it.

8. Final exam

The exam consists of implementing a numerical method with Matlab or Comsol for a differential equation of own interest.