



Finite element method course

Date: August 10-11, 2021

Location: Université de Neuchâtel

Lecturer: Dr. Marco Favino (UNIL)

Day 1: Continuous differential problems (Functional analysis)

Block 1

- Examples of partial differential equations (PDEs)
- Classification of second order PDEs
- Boundary conditions
- Darcy's equation for heterogeneous porous media
- Regularity of the solution
- The need for weak formulations

Block 2

- Distance, norm and scalar product
- Functionals and function spaces
- Hilbert spaces

Block 3

- Bilinear forms
- Weak formulation of differential problems
- Lax-Milgram theorem

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Day 2: Discretization of differential problems (Numerical analysis)

Block 4

- Introduction to discretization and Galerkin method
- Bases
- Stiffness matrices and its properties
- Analysis of the Galerkin method: existence, uniqueness, stability of the discrete solution

Block 5

- Analysis of the Galerkin method: convergence of the discrete solution to the solution of the continuous problem
- Meshes and interpolation spaces
- Finite element method (FEM) and convergence

Block 6

- Assembly of stiffness matrix for FEM
- Discrete maximum principle and positivity of the solution
- Time-dependent and non-linear problems

People wishing to participate have to register online:

<https://www.unine.ch/phdschool-wes/home/programme.html>

Participation costs are covered only for the WES PhD school members.

Contact: school.earth-water@unine.ch