



UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA / PHD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Ad hoc course announcement

Title: **Mathematics of the Finite Element Method
Essentials for the numerical treatment of elliptic pdes**

Lecturer: **Prof. Francesco Calabrò**
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Credits: **5**

Overview

The course is borrowed from the UniNA PhD Program in Mathematics and Applications.

Lectures are *online* on the University platform Microsoft Teams.

Team: "Mathematics of the Finite Element Method - PhD course" - Team Code: 17e9mj9.

There will be a final assessment for ITEE students.

Lecture	Date	Time	Topics
1	27/04/2020	10:00 - 12:00	Essential notions on Sobolev spaces (traces in H^1 , dual spaces); variational formulation of the Poisson problem (in dimension > 1) and good position (Lax-Milgram).
2	30/04/2020	11:00 - 13:00	Galerkin method, Cea lemma in the general and symmetric case; various examples of elliptic problems.
3	04/05/2020	11:00 - 13:00	Estimation of the interpolation error: definition of the interpolator; Deny- Lions theorem; related finite elements and reference element, scaling argument; error estimate for the Galerkin method in the Poisson case both in norm H^1 and L^2 (Aubin-Nitsche).
4	07/05/2020	11:00 - 13:00	First Strang lemma and quadrature error analysis for linear elements; Second Strang lemma and analysis of the error of approximation of the domain for linear elements.
5	11/05/2020	11:00 - 13:00	Some implementation issues: the structure of a finite element code.
6	14/05/2020	11:00 - 13:00	The diffusion-transport problem with dominant transport: exact solution and numerical difficulties. Description of the "non-conforming artificial- diffusion" (NCAD) and "streamline-upwind Petrov-Galerkin" (SUPG) methods; error analysis for SUPG.
7	18/05/2020	11:00 - 13:00	Stokes Equation: inf-sup condition for the Babuška-Brezzi theorem. Mixed finite element methods.
8	21/05/2020	11:00 - 13:00	Darcy problem: implementation of mixed finite elements RT0-P0.
9	25/05/2020	11:00 - 13:00	Isogeometric method for elliptic problems.
10	28/05/2020	11:00 - 13:00	Extensions and open questions.
	TBD	TBD	Assessment test

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