



DOCTORAL PROGRAMME IN MATHEMATICAL SCIENCES

TITLE: Two Generalizations of FEM: Adaptive and Virtual Elements

LECTURERS: L. Beirao da Veiga and A. Veeser

One part of the course will be an introduction to the Virtual Element Method, starting from the basic ideas and later considering also some more advanced topic. The Virtual Element Method (in short VEM, introduced in [2012]) is a very recent generalization of the Finite Element Method that takes inspiration from modern Mimetic Finite Differences. The advantage of Virtual Elements is the ductility that allows to have easily high order accuracy and high order continuity, in addition of being able to represent in an exact way certain physical properties (conservation, incompressibility, etc.) and of being applicable in very general geometries. The VEM allows, in particular, to make use of general polygonal and polyhedral meshes (also for high order schemes) without the need (as in polygonal FEM) of complicated integration on the elements.

The other part of the course will be an introduction to Adaptive Finite Element Methods (AFEM). Adaptivity is key tool to improve the quality-cost balance for a given discretization of a partial differential equation and relies on so-called a posteriori error estimators. These are computable quantities, depending on the discrete solution(s) and data, that can be used to assess the approximation quality and improve it in an iterative process. The lectures will present the derivation of upper and lower a posteriori error bounds for residual-type estimators, including a critical look at the role of oscillation, a discussion of the design of adaptive methods as well as their convergence properties.

Some basic knowledge on the finite element method, Sobolev spaces and the weak formulation of elliptic partial differential equations will be assumed.

MORE INFORMATION:

All lectures will be held in italian or english (if there is some non-italian speaker attending).

Aula Dottorato, Dipartimento di Matematica, Via Saldini 50, Milano.

The schedule of the first part on VEM is as follows:

Monday 14/9, 15:00-17:00

Thursday 17/9, 10:00-12:00 and 14:00-16:00,

The second part on AFEM will be held regularly on Monday, 9:30-11:30, from 21/9 to 19/10 and on Monday, 26/10, 14:30-16:30.

