MÉTHODE DES ÉLÉMENTS FINIS, DE LA THÉORIE À LA MISE EN OEUVRE

FINITE ELEMENT METHOD, FROM THE THEORY TO IMPLEMENTATION

Lecturers: Abdel-Malek ZINE

| Lecturers : 24.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 8.0 | Project : 0.0 | Language : FR

Objectives

In the engineering field, there are several approximation techniques allowing to solve the differential equations or the partial derivatives governing the studied phenomena.
The most widely used is the Finite Element Method. This method makes it possible to treat any kind of geometry, any kind of boundary value problem arising from electromagnetism, acoustics, fluid mechanics, solid mechanics, biology and even finance! Moreover, This method has a rigorous mathematical approach, based on variational methods.
This mathematical approach makes it possible to predict the accuracy of the approximation and to improve it

Keywords : Boundary value problems, Variational formulations, Numerical approximation, Finite Element Method, Error estimates

Programme

The variational problem, an abstract framework
Elliptic boundary value problems
Finite element method, approximation of boundary value problems
Application to selected engineering problems
a priori and a posteriori error estimates
Finite element method for the evolutionary problems (parabolic and hyperbolic)

Learning outcomes

- To be able to write and analyse a variational formulation
- To be able to write and analyse a finite element approximation
- To be able to write a Matlab procedure allowing to solve the approximated problem

Independent study

Objectifs :

Méhodes :

Core texts

A. Ern et J. L. Guermond, *ELÉMENTS FINIS : THÉORIE, APPLICATIONS, MISE EN OEUVRE*, Mathématiques et applications, Springer, 2002
J. Rappaz et M. Picasso. *INTRODUCTION À L'ANALYSE NUMÉRIQUE*, Presses polytechniques et universitaire romandes, 1999
A. Quarteroni and A. Valli*NUMERICAL APPROXIMATION OF PARTIAL DIFFERENTIAL EQUATIONS*, Springer, 2008

Assessment

- 2-hour supervised Exam.
- Reports of two practical works