



INTRODUCTION TO THE FINITE ELEMENT METHOD. NUMERICAL SIMULATION WITH FREEFEM++

Lecturers: M. Victoria Redondo Neble and J. Rafael Rodríguez Galván (University of Cadiz, Spain)

Period: June 23-25, 2014. *Schedule:* see the table below.

Final evaluation: written tests and/or exercises.

Registration: By emailing Prof. Giuseppe Viglialoro (giuseppe.viglialoro@unica.it)

COURSE OVERVIEW

This course is structured in two main parts:

Unit 1, entitled "*Introduction to the Finite Element Method (FEM)*".

Unit 2, entitled "*Numerical simulation with FreeFem++. Examples on fluid models*".

The topics that will be discussed and analyzed in each Unit are the following:

Unit 1 (5 hours), presented by Prof. *M. Victoria Redondo Neble*

1. Examples of mathematical models governed by EDP.
2. The Finite Difference Method.
3. The Galerkin Method. Error and convergence. The Finite Element Method.
4. Lagrange and Hermite finite elements.
5. Mixed finite elements. Introduction to resolution of the Stokes problem.

Unit 2 (5 hours), presented by Prof. *J. Rafael Rodríguez Galván*

1. The finite element assistant Freefem++. Installation, configuration and first steps.
2. The Freefem++ programming language.
3. Steady equations. Using mesh generators and external post-processors.
4. Transient equations. Videos in Paraview.
5. Numerical resolution of the Stokes equations in realistic domains.

Remark: Due to its practical nature, all the participants are strongly suggested to use a laptop during Unit 2, with these two on-line available programs installed: FreeFem++ and Paraview.

SCHEDULE OF THE COURSE

Day Time	Monday June, 23	Day Time	Tuesday June, 24	Day Time	Wednesday June, 25
9:00 AM	Unit 1	9:00 AM	Unit 1	9:00 AM	Unit 1
10:00 AM	Unit 1	9:45 AM	Unit 1	9:45 AM	Unit 1
Break		Break		Break	
10:15 AM	Unit 1	10:00 AM	Unit 1	10:00 AM	Unit 1
11:15 AM	Unit 1	10:45 AM	Unit 1	10:45 AM	Unit 1
Break		Break		Break	
11:30 AM	Unit 2	11:00 AM	Unit 2	11:00 AM	Unit 2
12:30 PM	Unit 2	12:00 PM	Unit 2	11:45 AM	Unit 2
Break		Break		Break	
12:45 PM	Unit 2	12:15 PM	Unit 2	12:00 PM	Unit 2
1:15 PM	Unit 2	1:15 PM	Unit 2	12:45 PM	Unit 2