

# MAE 656 - Advanced Computer Aided Design

01. Introduction – Doc 01

**COURSE DESCRIPTION**

# Course Basics

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Instructor: Dr. Xavier Martinez

Contact:

by e-mail: [x.martinez "at" upc.edu](mailto:x.martinez@upc.edu)

web: <https://web.cimne.upc.edu/users/xmartinez/>

office: ESB 549

Class Hours: Mon-Thurs – 10:30am to 12:05pm  
(instead of Mon-Fri – 10:30 to 11:45)

Contact hours:

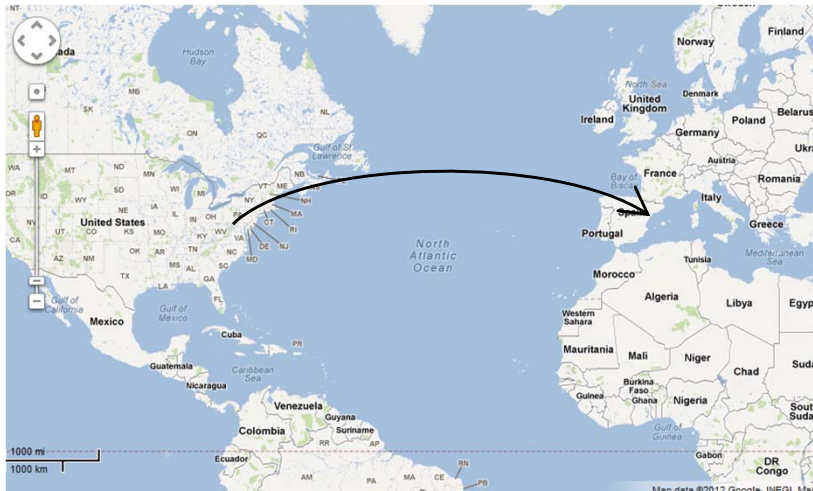
After class (in the same room)

From 12:15pm to 1:30pm at the office

# A little bit about me

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Professor at the  
Nautical Engineering School  
and at the  
Civil Engineering School of the  
Universitat Politecnica de Catalunya, Barcelona, SPAIN



# A little bit about me

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Civil Engineer

Worked 3 years designing bridges and other singular structures

Afterwards I returned to the university to do my PhD. I worked on the numerical simulation of composite structures:

*"Micro-Mechanical Simulation of Composite Materials Using the Serial/Parallel Mixing Theory"*

Post-doctoral fellow at WVU working in the Resilient Tunnel Project

Research interests:

The main topic would be NON-LINEAR CONSTITUTIVE MODELLING.  
Here we can include:

Composites – Homogenization techniques –  
Nano-materials – Fatigue (on metals and composites)

# Documentation

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## FEM references

O. C. Zienkiewicz, R. L. Taylor, J.Z. Zhu, *The Finite Element Method: Its Basis and Fundamentals*. Sixth Edition. Butterworth-Heinemann (2005).  
ISBN 978-0750663205

## Ansys

Kent Lawrence. *ANSYS Workbench Tutorial Release 13*. Cambridge SDC Publications (2011), ISBN 978-1585036714

Huei-Huang Lee. *Finite Element Simulations with ANSYS Workbench 13. Theory – Applications – Case Studies*. SDC Publications (2011), ISBN 978-1585036530  
ANSYS User Manual

## Course documents

<https://web.cimne.upc.edu/users/xmartinez/MAE656/>

# Course Outline (1/3)

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## 01 – Introduction to the Finite Element Method

- 1.1. Overview of the finite element method
- 1.2. Available elements in a FEM code
- 1.3. Solution of truss and beam elements (using strength of materials formulation)
- 1.4. Solution of 2D elements

## 02 – ANSYS Workbench

- 2.1. Description of Ansys Workbench
- 2.2. Engineering data
- 2.3. Geometry
- 2.4. Boundary Conditions
- 2.5. Meshing
- 2.6. Solution options

# Course Outline (2/3)

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## 03 – Beam and Truss elements

- 3.1. Geometry definition – structure and sections
- 3.2. Solution of truss structures
- 3.3. Solution of beam structures

## 04 – Solution of Solid Problems: 2D & 3D

- 4.1. Convenience of using 2D or 3D
- 4.2. Solution of 2D structures
- 4.3. Solution of 3D structures

# Course Outline (3/3)

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## 05 – Shell Problems

- 5.1. Shell & membrane elements. Theoretical background
- 5.2. Solution of shell problems
- 5.3. Application to composite materials.

## 06 – Preparing and presenting a CAD project

- 6.1. Model definition and relevant information
- 6.2. Presentation of results
- 6.3. Description of final project

# Grading

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The course will be graded based on the performance in:

4 Week assignments (groups of 2)	1.75p each
1 Course project (individual)	3.0p

The course project will be presented to the whole class the last week. A printed (or pdf electronic) copy will be given to the instructor.