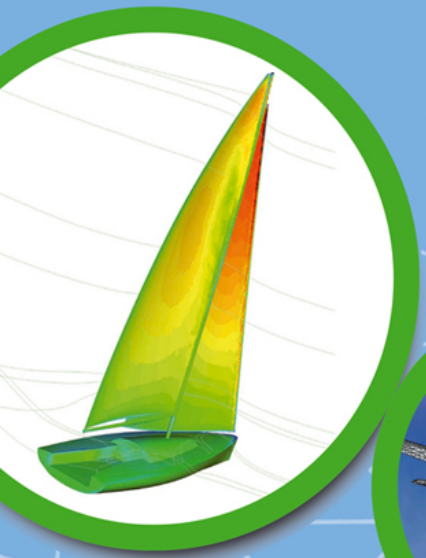
master of science in

Computational Mechanics



Computational Mechanics Tools

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Master's Secretariat
International Center for Numerical Methods in Engineering (CIMNE)

Education and Culture
Erasmus Mundus
UNIVERSITAT POLITÈCNICA DE CATALUNYA
PRIFYSGOL CYMRU ABERTAWE
UNIVERSITY OF WALES SWANSEA
Centrale Nantes
Universität Stuttgart

Description

This module presents several tools that are useful in computational mechanics:

→ Mesh generation algorithms

→ Mesh generation packages (GiD)

→ FEM commercial package (Abaqus)

Contents

→ Introduction to computer modelling

→ Mesh generation: structured, unstructured and mesh optimization

→ Governing physics: thermal, mechanical, fluids, diffusion,...

→ Overview of numerical approaches:

- Finite difference, **finite elements**, finite volumes
- Dynamics: time marching schemes,...

→ Commercial and non-commercial codes

- Solvers: ABAQUS, student edition available at
  http://academy.3ds.com/software/simulia/abaqus-student-edition/
- Pre and post-process: GiD, a 1-month testing licence (which can be extended to up to 3 months) is available at
  http://www.gidhome.com/passwords

→ Solution of practical problems

Assessment

→ 30% Assignments
30% Course GiD project
40% Course Simulation Project

→ Homework has to be done individually

→ Course projects to be worked out in teams of 2 students (except online students)
- A selection of topic will be proposed
- Guidelines will be published in the Virtual Campus

→ Deadlines:
- Assignment 1: 15th November 2019 (jose.sarrate@upc.edu)
- Assignment 2: 13th December 2019 (amir.abdollahi@upc.edu)
- Assignment 3: 12th January 2020 (natividad.pastor@upc.edu)
- Course Gid Project: 19th January 2020 (escolano@cimne.upc.es)
- Course Simulation Project: 19th January 2020 (amir.abdollahi@upc.edu)

Schedule

Computational Mechanics Tools **2019-2020** Lecturers: Amir Abdollahi (**AA**), Nati Pastor (**NPT**), Josep Sarrate (**JSR**), **GID Team**

Week Day	Date	Hour	Session	Topic	Room	Prof.
Monday	7-Oct-19	11:00-13:00	S01	Introduction to Comp. modeling in the context of Eng. Sciences	TBA	**AA**
Wednesday	9-Oct-19	8:00-10:00	S02	Introduction to mesh generation. Structured mesh generation	TBA	**JSR**
Monday	14-Oct-19	11:00-13:00	S03	Unstructured mesh generation	TBA	**JSR**
Wednesday	16-Oct-19	8:00-10:00	S04	Practical session with GID: Introduction	TBA	**GiD Team**
Monday	21-Oct-19	11:00-13:00	S05	Mesh optimization and mesh adaption algorithms	TBA	**JSR**
Wednesday	23-Oct-19	8:00-10:00	S06	Practical session with GID: Meshing	TBA	**GiD Team**
Monday	28-Oct-19	11:00-13:00	S07	Introduction to Nurbs	TBA	**JSR**
Wednesday	30-Oct-19	8:00-10:00	S08	Practical session with GID: Customization	TBA	**GiD Team**
Monday	4-Nov-19	11:00-13:00	S09	Practical session with GID: A complete case	TBA	**GiD Team**
Wednesday	6-Nov-19	8:00-10:00	S10	Modeling exercise with pdetool	TBA	**AA**
Monday	11-Nov-19	11:00-13:00	S11	Governing Physics	TBA	**AA**
Wednesday	13-Nov-19	8:00-10:00	S12	Exercise on heat transfer	TBA	**AA**
Monday	18-Nov-19	11:00-13:00	S13	Discretization methods. FEM. Overview of commercial FE software	TBA	**NPT**
Wednesday	20-Nov-19	8:00-10:00	S14*	Introduction to Abaqus	TBA	**NPT**
Monday	25-Nov-19	11:00-13:00	S15*	The mechanical problem I (linearly elastic and stationary)	TBA	**NPT**
Wednesday	27-Nov-19	8:00-10:00	S16*	Linear elasticity with Abaqus	TBA	**NPT**
Monday	2-Dec-19	11:00-13:00	S17	Dynamics	TBA	**NPT**
Wednesday	4-Dec-19	8:00-10:00	S19*	Dynamics with Abaqus	TBA	**NPT**
Monday	9-Dec-19	11:00-13:00	S19	Nonlinear problems	TBA	**AA**
Wednesday	11-Dec-19	8:00-10:00	S20*	Exercise on Plasticity (Abaqus)	TBA	**NPT**
Monday	16-Dec-19	11:00-13:00	S21*	Course Project session	TBA	**NPT**
Wednesday	18-Dec-19	8:00-10:00	S22	No Class (Course Project Office Time)	TBA	**NPT**
Friday	19-Jan-20	TBA	S23	Course project presentations	TBA	**AA + NPT**

References

→ Faux D. and Pratt M.J. *Computational Geometry for Design and Manufacture*, Elli Horwood Publishers, 1987.

→ Thompson J.F., Soni B.K., and Weatherill N.P., *Handbook of Grid Generation*, CRC press, 1999

→ Topping B.H.V., Muylle J., Iványi P., Putanowicz R., Cheng B., *Finite Element Mesh Generation*, Saxe-Coburg Publications, 2004.

→ GiD homepage http://www.gidhome.com/

→ Zienkiewicz, O.C.; Morgan. K.. ***Finite elements and approximation***. Dover Publications. 2006.

→ http://www.3ds.com/products/simulia/overview/