



Dottorato in **Ingegneria Civile e Architettura**

PhD programme in **Civil Engineering and Architecture**

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Insegnamenti avanzati erogati dai Corsi di Dottorato afferenti alla SDIA (ICD)

Advanced courses provided by PhD programmes related to SDIA (ICD)

## **INTRODUCTION TO NON-LINEAR PROBLEMS IN MECHANICS**

*Prof. Roberto Brighenti*

CFU 2 (1 CFU = 6 h in class lectures)

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### **Syllabus**

CHAPT. 1 - INTRODUCTION TO NONLINEAR PROBLEMS

CHAPT. 2 - BASIC ASPECTS OF NONLINEAR MECHANICS

CHAPT. 3 - SOLUTIONS OF NON-LINEAR PROBLEMS, ITERATIVE METHODS, CONVERGENCE CRITERIA (Example: nonlinear elastic problem)

CHAPT. 4 - INTRODUCTION TO PLASTICITY (Example: 1D elastic-plastic problem)

CHAPT. 5 - SIMULATION OF CONTACT PROBLEMS

CHAPT. 6 - SOLUTION OF MECHANICAL NON-LINEAR PROBLEMS WITH FINITE ELEMENTS



## Course details and timetable

The course will be offered in presence (Teaching hall 'N', engineering building, Science & Technology campus, Univ. of Parma) & online (by using Teams) according to the following calendar:

21<sup>st</sup> April 2022, 9:30-12:30

28<sup>th</sup> April 2022, 9:30-12:30

12<sup>th</sup> May 2022, 9:30-12:30

19<sup>th</sup> May 2022, 9:30-12:30

Registered students will receive the details to access the course online.

## Final evaluation

2 ECTS will be recognized upon passing a final oral exam.

Students will be asked to prepare a short report - deepening one of the topics covered in the course or a topic at their choice related to the contents of the course - to be presented and discussed with the teacher in a final oral discussion.

The dates of the oral exam will be communicated during the course.

**Registration** (deadline for registration: 19<sup>th</sup> April 2022, 5:00 PM)

Please register to the course by filling the [online form](#).

## References

- G.A. Holzapfel. Nonlinear solid mechanics: a continuum approach for engineering. Wiley, 2000.
- T. Belytschko, W.K. Liu, B. Moran, K. Elkhodary. Nonlinear Finite Elements for Continua and Structures, 2nd Edition, Wiley, 2013.
- P. Wriggers. Nonlinear Finite Element Methods. Springer, 2008.
- R. De Borst, M.A. Crisfield, J.J.C. Remmers, C.V. Verhoosel. Nonlinear Finite Element Analysis of Solids and Structures, 2nd Edition, Wiley, 2012.
- D.R.J. Owen, E. Hinton. Finite elements in plasticity: theory and practice. Pineridge Press, 1980.
- R. Brighenti, Analisi numerica dei solidi e delle strutture: fondamenti del Metodo degli Elementi Finiti. Esculapio Editore (Bologna), III Ed., 2019 (ISBN: 9788893851114).
- [Lecture notes](#) provided by the teacher.