Course Information - A.Y 2019/20

Computational Contact and Fracture Mechanics
Marco Paggi
20 Hours

Syllabus

Learning Outcomes:
The course provides a comprehensive overview of theory and numerics for the understanding and simulation of frontier research topics relevant for the design of innovative materials and structures.

Abstract:
This course provides an overview on the theories of contact and fracture mechanics relevant for a wide range of disciplines ranging from materials science to engineering. Introducing their theoretical foundations, the physical aspects of the resulting nonlinearities induced by such phenomena are emphasized. Numerical methods (FEM, BEM) for their approximate solution are also presented together with a series of applications to real case studies.

Lecture Contents:
The course covers the following topics:
- Hertzian contact between smooth spheres;
- the Cattaneo-Mindlin theory for frictional contact;
- numerical methods for the treatment of unilateral contact constraints;
- contact between rough surfaces;
- fundamentals of linear elastic fracture mechanics;
- the finite element method for crack propagation;
- nonlinear fracture mechanics and the cohesive zone model;
- interface finite elements;
- applications of fracture mechanics to materials science, retrofitting of civil/architectonic structures, composite materials;
- fatigue.

Teaching Method:
Lectures using blackboard and powerpoint slides.

Bibliography:
M. Paggi, D. Hills (2020) Modeling and Simulation of Tribological Problems in Technology, Springer, https://link.springer.com/book/10.1007/978-3-030-20377-1

Final Exam:
An application of the taught methodologies to a problem of interest for the PhD student's research is recommended. Alternatively, a topic for the exam can be suggested by the lecturer.

Prerequisites:
Numerical Methods for the Solution of Partial Differential Equations

Timetable and location:

All the classes will take place in the IMT School for Advanced Studies Lucca, Piazza San Francesco 19, Lucca.

Lesson	Date and time	Classroom
1	27/02/2020, 9.00-11.00	1
2	28/02/2020, 9.00-11.00	1
3	03/03/2020, 9.00-11.00	Sala della Botte
4	04/03/2020, 9.00-11.00	1
5	06/03/2020, 9.00-11.00	Sala della Botte
6	10/03/2020, 9.00-11.00	1
7	11/03/2020, 9.00-11.00	Sala della Botte
8	13/03/2020, 9.00-11.00	1
9	17/03/2020, 9.00-11.00	1
10	17/03/2020, 14.00-16.00	1

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