POLITECNICO DI MILANO

PhD Course: An Introduction to Nonlinear Solid Mechanics

The course is delivered to the **PhD students of Trento University and of Politecnico di Milano**, but is open to all other interested PhD students (and only PhD students, which means no Professors, no Master Students) in Italy and abroad. Classes will be delivered online by **Anna Pandolfi** in the period **November 7 - November 14, 2024**.

Overview. Rigorous introduction to nonlinear solid mechanics, especially addressing finite kinematics, material frame indifference, constitutive models within a thermodynamic framework. Analysis of nonlinear material behaviors.
Specific topics:

1. Mathematical preliminaries. Dual basis. Tensors.
2. Kinematics of deformations. Motions, kinematics of local deformation. Polar decomposition.
3. Conservation laws (mass, linear & angular momentum, energy). Thermodynamics. Virtual work principle.
4. Constitutive theories. Coleman-Noll's theory. Material frame indifference. Thermodynamic potentials. Kinetic relations. Material classification.
5. Hyperelasticity. Elasticity symmetry. Internal constraints. Elastic materials: isotropic, transversally isotropic, anisotropic materials.
6. Finite Plasticity. Multiplicative decomposition of the deformation gradient. Exponential and logarithmic mapping. J2 plasticity. Pressure dependent plasticity.
7. Special materials: fiber reinforced tissues, liquid crystals.

TEACHING ORGANIZATION

- The course, 5 credits for the Italian learning system, is delivered online in 8 lectures of 3 hours each plus 4 hours backup and verification, using the black board and ppt slides. Most lectures deal with theoretical explanations and proofs, supported by examples and applications. Lecture notes are provided. Standard textbooks in continuum mechanics and exercise material are suggested for further readings in each specific topic.
- Learning evaluation: theoretical exam on the whole program, by appointment **(Only for the Trento University and Politecnico di Milano students).**
- Interested students must enroll, by confirming their attendance by **November 3, 2024** to **anna.pandolfi@polimi.it**.
- In order to take the exam, Polimi students must be registered to the course @Polimi. Trento students must be registered to the course @Trento PhD school.

SCHEDULE and classrooms (Leonardo Campus)

		Thu	Mon	Tue	Wed	Thu
Date		**7-Nov-24**	**11-Nov-24**	**12-Nov-24**	**13-Nov-24**	**14-Nov-24**
10:15	11:15	Leo 2.1.5				Leo 2.1.5
11:15	12:15	Leo 2.1.5	Leo 2.1.3	Leo 2.1.3		Leo 2.1.5
12:15	13:15	Leo 2.1.5	Leo 2.1.3	Leo 2.1.3		Leo 2.1.5
13:15	14:15		Leo 2.1.3	Leo 2.1.3		
14:15	15:15				Leo 2.1.3	
15:15	16:15	Colombo EP1	Leo 2.1.3	Leo 2.1.3	Leo 2.1.3	Colombo EP1
16:15	17:15	Colombo EP1	Leo 2.1.3	Leo 2.1.3	Leo 2.1.3	Colombo EP1
17:15	18:15	Colombo EP1	Leo 2.1.3	Leo 2.1.3	Leo 2.1.3	Colombo EP1

The course will be also streamed in webex. Access will be granted only to the enrolled students.

A password protected **OneDrive folder** will be used to distribute the material of the course.