



UNIVERSITÀ
DI TRENTO



National Technical
University of Athens

Erasmus+

Blended Intensive Program

Paris 2-7 March 2025

<https://erasmus-plus.ec.europa.eu>

Nonlinearities in Solid Mechanics: instabilities, waves, plasticity in 1D models

3

ECTS (European Credit Transfer System)

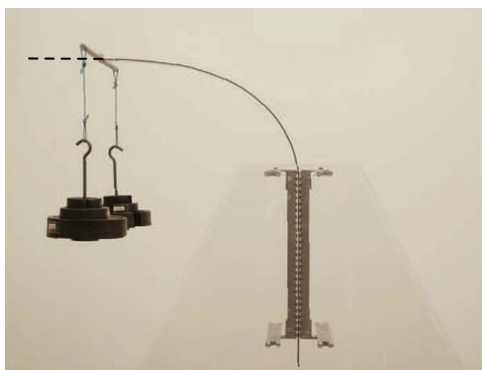
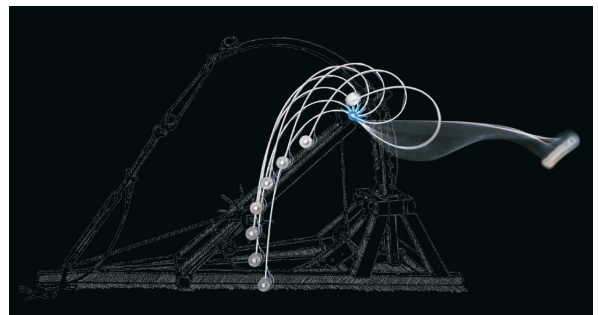
5

days at Sorbonne University, Paris, March 2-7, 2026

3

European universities

Dive into the fascinating world of nonlinear solid mechanics through a unique blend of theory, computation, and applications. This course guides you from fundamental principles to advanced modeling techniques, equipping you with the tools to analyze and simulate complex nonlinear behaviors in one-dimensional mechanical systems.



Designed for learners with a basic background in solid mechanics and numerical methods (or calculus), the course is structured into three interconnected parts:

- Optimisation, Calculus of Variations and Numerics
- Planar elastica: Nonlinear beams and instabilities
- Waves and inelastic solids

The course will consist of an online introductory lecture, five days of in-person attendance at Sorbonne University (2-7 March 2026), and an oral project-based online examination. Approximately 30 students from National Technical University of Athens (Athens, Greece), University of Trento (Italy), and Sorbonne University (Paris University) will participate. Lectures will be delivered by professors from the three institutions.

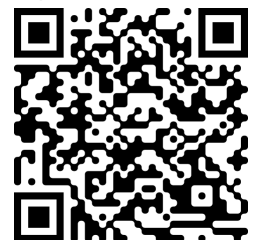
During the in-person week at Sorbonne University (Jussieu) in Paris, frontal teaching will be alternated with assisted teamwork. Computer laboratories will also be established.

Eligible applicants for Sorbonne include students in the second to first year of mechanical engineering.

Who can apply in Sorbonne: students from L3 to M1 in mechanics

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<https://h1.nu/1bYsU>



Fill the form at this link
if you are interested before
01/11/2025

Course Program

Part I: Optimisation, Calculus of Variations and Numerics

- Minimizing $V(\mathbf{x})$ with $\mathbf{x}$ in R^n , without and with equality (kinematics) and inequality (contact) constraints
- Energy functionals and constraints, Euler–Lagrange equations and stability
- Shooting ODEs/IVP/BVP, going discrete, minimizing with Mathematica and Python

Part II: Planar elastica

- Kinematics and Statics of the Planar elastica
- Analytical solutions with elliptic integrals
- Euler buckling, snap instability, moving boundary problems (variable length)
- Discretization of the equations
- Stability

Part III: Waves and inelastic models

- Vibrations and flexural waves
- 1D plasticity: elastic–plastic response with hardening effects
- Viscoplasticity, hysteresis, and cyclic loading

During the in-presence week at Sorbonne University (Jussieu) in Paris, frontal teaching will be alternated with assisted teamwork.

By the end of the course, you will have a solid theoretical foundation combined with hands-on numerical skills to tackle real-world nonlinear mechanics problems across engineering and applied physics.

The lectures will be given by three professors, one from each of the three institutions involved in the project.

Computer laboratories will also be organized.

Further information: contact Corrado Maurini