

**Course offered for the PhD program
in Civil, Chemical and Environmental Engineering
Curriculum in Structural and Geotechnical Engineering, Mechanics and Materials
a.a. 2021/2022 (XXXVII ciclo)**

(course is open for participation of students from other PhD cycles or programs)

1. Title

Multi-scale modelling of inhomogeneous materials and metamaterials

2. Course Description

Composite materials with disordered and periodic and non-ordered microstructures. Multiscale modeling of materials with disordered microstructure. Dilute and non-dilute distribution of defects. Multi-scale description. Classical homogenization of materials with periodic microstructure: heuristic and asymptotic approaches. Examples. Computational homogenization. Non-classical homogenization of materials with periodic microstructures: Cosserat and non-local high gradient models. Internal and characteristic lengths. Discussion on the role of non-local continuum model in the structural analysis of inhomogeneous structures. Exotic microstructures: auxetic and chiral materials. Damage localization in periodic materials: shear bands in layered materials with brittle interfaces.

Dispersive waves in heterogeneous materials with periodic microstructures. Floquet-Bloch theory and frequency spectra. Effect of the microstructure on the frequency spectra. Pass and stop frequency bands. Examples: grid lattices, periodic blocky materials, granular materials.

3. Course Organization

The course is provided via theoretical lectures and some applications to particular material microstructures.

4. Teacher

Luigi Gambarotta

5. Duration and credits

15 hours, 3 credits

6. Activation mode and teaching period

Spring 2022

Application: email message to the teacher (luigi.gambarotta@unige.it)

7. Deadline for registration

January, 31, 2022

8. Final exam

The final exam is oral, in the period May-July 2022.