



Visiting Professor Program Academic Year 2024/2025

TEACHING COMMITMENT: 12 hours

COURSE TITLE

Seismology and Earthquake Mechanics

TEACHING PERIOD

2nd term

SCIENTIFIC AREA

Solid Earth Geophysics

LANGUAGE USED TO TEACH

English

COURSE SUMMARY

Waves propagation in elastic media -Stress tensor – Deformation tensor – Relationships between stresses and deformations – Equations of motion in terms of displacement – Equations of waves – Compressional and shear waves

Seismic waves – Classification of seismic waves – Propagation of seismic waves – Earth inner structure – Earthquakes localisation – Lithosphere structure – Lithosphere dynamics

Deformation and failure - Stress and strain analysis - Fracture mechanics and elastic moduli.

Ground motion records - Definition and general principles – Response curve of seismographs – Main types of seismographs

Seismic source – Dynamical parameters of the seismic source – Fault propagation - Elastic rebound theory and focal mechanisms - Maths representation of hypocenter phenomena

Inverse problem and seismic tomography – Problem inverse definition – Data and model spaces
Seismic Tomography – earthquakes Localization

Earthquakes size – Earthquakes magnitude – Earthquakes intensity – Earthquakes statistics - Clustering parameters – Microseismicity and applications
Earthquakes mechanics in laboratory. Experimental determination of mechanical parameters in uniaxial, triaxial, extension and shear strength. Elastic deformation, brittle and ductile. Mechanical anisotropy and micromechanical models. Deformation mechanisms and physical properties. Experimental determination of physical parameters (density, porosity, elastic waves velocity). Friction and laborator.

LEARNING OBJECTIVES

The course aims to provide theoretical and experimental tools finalised to the knowledge of earthquakes generation processes and waves propagation. The student will be introduced to the processes driving earthquake ruptures, to the analysis and modelling of seismic data to determine the main source parameters and to the seismotectonically active areas for big earthquakes, and the methodologies for seismic hazard mitigation and earthquakes forecasting. In detail laboratory techniques will be developed finalised to the measurement of rocks physico-mechanical parameters and to the description of the rheological behaviour during the pre-failure and coseismic deformation processes.

VISITING PROFESSOR PROFILE

Knowledges in Rock Physics and Seismology, Experimental Rock Deformation and Rock Physical Properties, Acoustic Emissions (Laboratory Earthquakes) and high temperature processes for geophysical signatures identification.

CONTACT REFERENT

Sergio Carmelo Vinciguerra
sergiocarmelo.vinciguerra@unito.it