UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Laboratory of Microzonation

2425-1-F7401Q113

Aims

"Microzonation Laboratory" aims to provide the student with the basic knowledge, survey methods and application procedures useful in carrying out seismic microzonation studies.
In addition to introducing some concepts of applied seismology, with special emphasis on site effects and local seismic response, and describing geological and geomorphological methods of analysis, the practices adopted for the design and execution of investigations and the strategies for calculating local seismic response and amplification factors will be illustrated..

Contents

The course is structured in two modules: the first is on the study of seismic shaking and earthquake-induced ground effects, and the second describes the contribution of geophysics in seismic microzonation studies. In the first part, the basic concepts of seismology will be introduced to understand the site contribution in characterizing seismic shaking. Ground motion records and parameters, the seismic archives, and the main empirical methods for estimating seismic amplification will be described. Numerical methods for calculating local seismic response will be explained, with applications in the one-dimensional case. Seismic classification criteria, guidelines for seismic microzonation and technical standards adopted in Italy will also be introduced.
In the geophysics module, guidance will be provided on the planning and execution of measurements, so that the student will be able to operate profitably with basic geophysical instrumentation, design and execute surface geophysical investigations, process and interpret data and communicate the results. The theoretical and practical basis of the main methods of subsurface geophysical exploration will also be provided; describing the physical principles of the methods, their limitations, measurement and processing techniques, and interpretive models. Examples of geophysical survey planning in microzonation studies, data processing and interpretation will be provided. In addition to lectures, the course will include practical exercises in data acquisition and analysis and numerical simulation of simple subsoil models.

Detailed program

LECTURES
During the lectures, the main concepts of applied seismology and one-dimensional numerical modeling will be covered, presenting many practical examples. The main characteristics of seismic recordings, processing techniques for deriving ground motion parameters, and the operation of accelerometer databases will be explained. Fourier spectrum, acceleration response spectrum the principles of technical standards (NTC18) will be presented. Next, site effects will be discussed, showing how they modify seismic motion, and the main numerical and empirical techniques for their estimation will be shown. Seismic site classification schemes, geological, geophysical and seismological parameters representative of local seismic response, and the principles and guidelines of seismic microzonation in Italy will also be illustred during the course. Some seismic microzonation studies will be explained in detail, with examples of applications of both empirical and numerical analysis methods
For the geophysical part, guidance for planning geophysical surveys will be provided and procedural schemes of geophysical activities will be detailed, including protocols, best practices, products and results that support Level III of the seismic microzonation studies.
The principles of active and passive geophysical methods will be described with emphasis on acquisition strategies and data quality assessment methods.
Active and passive seismic methods: principles and applications; refraction seismic; reflection seismic and their applications. MASW, REMI, ESAC, HVSR, DOWN-HOLE and CROSS-HOLE. Emphasis on acquisition strategies and data quality assessment methods.
LABORATORY
Laboratory and in situ exercises are designed. Practical laboratory exercises will cover feasibility assessment and survey planning, description of instrument characteristics, and through the use of specific dedicated software, data processing and interpretation will be carried out. During the exercises, databases will be used for selection of spectrum-compatible seismic recordings and their use for calculation of amplification functions by linear and linear-equivalent methods. On-site exercises for a real case study are planned.

Prerequisites

Suggested geophysical prospecting and applied seismology courses

Teaching form

21 two-hour lectures, in person, Delivered Didactics
2 three-hour field activities, in person, Interactive Teaching

Textbook and teaching resource

All teaching material is available.

- Telford W.M., Geldart L.P.and Sheriff R.E., Applied Geophysics. Cambridge University Press, 1991.
  -Reynolds J.M., An Introduction to Applied and Environmental Geophysics, John Wiley and Sons.
  -Sharma P.V., Environmental and engineering geophysics, Cambridge University Press.
- Kearey, P., M. Brooks, I. Hill. An Introduction to geophysical Exploration. Blackwell Pub., ISBN 0-632-04929-4.Press.
- Kramer, S.L. (1996). Geothecnical Earthquake Engineering, Prentice-Hall Civil Engineering and

Engineering Mechanics series,
- Indirizzi e criteri per la Microzonazione sismica Parte1 e Parte 2 (2008). https://www.centromicrozonazionesismica.it/it/download/category/7-indirizzi-e-criteri-per-la-microzonazione-sismica

Semester

Second semester (February - June)

Assessment method

Seven exam sessions of the Microzonation Laboratory are scheduled at the beginning of the Academic Year. The examination is oral and we evaluate the acquired competence, the exposure completeness and language property, as well as a report describing a microzonation study to be conducted during the course.

Office hours

On appointment. Contact the teachers at the following email addresses: grazia.caielli@idpa.cnr.it and francesca.pacor@ingv.it

Sustainable Development Goals