CIVIL-522

Seismic engineering

Lignos Dimitrios, Saloustros Savvas, Vanin Francesco

Cursus	Sem.	Type
Civil Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	6
Session	Summer
Semester	Spring
Exam	Written
Workload	180h
Weeks	14
Hours	**6 weekly**
Lecture	4 weekly
Exercises	2 weekly
Number of positions	

Summary

This course deals with the main aspects of seismic design and assessment of buildings including conceptual design. It covers different structural design and evaluation philosophies for new and existing reinforced concrete, steel and unreinforced masonry buildings.

Content

- Introduction (seismicity worldwide and in Switzerland, typical failure modes of buildings and their primary structural elements)
- Conceptual seismic design
- Seismic analysis methods (response spectrum method, equivalent lateral force method)
- Design philosophies (conventional design and capacity design)
- Design an evaluation methods (force-based and displacement-based methods and their advantages and disadvantages, N2 method, risk-based assessment according to SIA 269/8)
- Seismic design of reinforced concrete wall buildings (capacity design of reinforced concrete walls)
- Seismic design of steel buildings (moment-resisting frames, braced frames, eccentrically-braced frames)
- Seismic design and assessment of unreinforced masonry buildings (overview on typologies of masonry buildings, capacity and demand of in-plane and out-of-plane modes, seismic response of historical masonry buildings)
- Seismic retrofit of buildings with supplemental damping devices (buckling-restrained bracings, friction dampers)
- Seismic retrofit of , unreinforced masonry buildings

Keywords

Seismic design and assessment of buildings, reinforced concrete buildings, steel buildings, unreinforced masonry buildings, seismicity, supplemental damping, seismic retrofit.

Learning Prerequisites

Required courses

- Dynamics of structures (CIVIL-468)
- Reinforced concrete structures (CIVIL-323)
- Design of steel structures (CIVIL-235)
- Statics I (CIVIL-124), Structural mechanics (for GC) (CIVIL-238), Continuum mechanics (CIVIL-225),

Statics II (CIVIL-224)

Recommended courses

- Structural dynamics
- Design of reinforced concrete structures
- Analysis of isostatic and hyperstatic systems

Learning Outcomes

By the end of the course, the student must be able to:

- Explain the effects of an earthquake on buildings
- Design wall-type structures (RC and URM) for earthquakes
- Design steel frames for earthquakes
- Manage and Know about seismic assesment frameworks
- Propose seismic retrofit solutions

Teaching methods

Lectures, exercises

Expected student activities

- Solution of assignments
- Active participation in case studies (in-class exercises)

Assessment methods

- Assignments
- Midterm exam (written)
- Final exam (written)

Resources

Bibliography

- Slides, scientific papers and book excerpts are shared through moodle
- Video recordings of courses from previous years

Recommended reading:

- Michel Bruneau, Chia-Ming Uang, and Rafael Sabelli "Ductile design of steel structures", McGraw-Hill Education, 2011. http://www.michelbruneau.com/DuctileDesign.htm
- Edmund Booth "Earthquake Design Practice for Buildings", Thomas Telford, 3rd edition, 2014.
- Pierino Lestuzzi, Marc Badoux "Génie parasismique", Presses polytechniques et universitaires romandes, 2008.
- Pierino Lestuzzi, Marc Badoux "Evaluation parasismique des constructions existantes", Presses polytechniques et universitaires romandes, 2013.

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Ressources en bibliothèque

- Ductile design of steel structures / Bruneau
- Génie parasismique / Lestuzzi, Badoux
- Earthquake design practice for buildings / Booth
- Evaluation parasismique des constructions existantes / Lestuzzi, Badoux

Moodle Link

- https://go.epfl.ch/CIVIL-522

Prerequisite for

- Nonlinear analysis of structures (CIVIL-449)
- Master projects in seismic engineering