

Probabilistic Seismic Risk Analysis and Management for civil systems

2 0 1 8 Syllabus

Time

- Monday, 15PM-17PM, (14:45PM-16:30PM)

Location

- HIT J52, ETH Zurich, Hönggerberg

Principal Lecturer

- Marco Broccardo, IBK & SCCER-SoE, ETH Zürich

Guest Lecturers

- Simona Esposito, Swiss Re
- Panagiotis Galanis, UBS
- Bastian Bergmann, ETH Risk Center

Professor

- Bozidar Stojadinovic, IBK ETH Zürich

Course Description

This course extends the series of two courses on seismic design of structures at ETHZ and introduces the topic of probabilistic seismic risk analysis and seismic risk management for the build environment and civil infrastructure systems. The following advanced topics will be covered in this course: 1) Probabilistic Seismic Hazard Analysis (PSHA); 2) Probabilistic Seismic Risk Analysis (PSRA); 3) Seismic risk management using structural and financial engineering means; and, time permitting, 4) advanced topics in systemic probabilistic risk evaluation.

Course Outcomes

After successfully completing this course the students will be able to:

- Master probabilistic models for Earthquake engineering problems.
- Conduct a PSHA for a site, and produce a Seismic Hazard map.
- Conduct a PSRA of a building and produce a Seismic Risk map.
- Design structural and/or financial engineering solutions to mitigate the seismic risk at a site.

Prerequisites

ETH Seismic Design of Structures *I* course is strongly recommended but not mandatory. Basic knowledges of Probability and Statistics are useful but not required. Students are expected to understand the seismological nature of earthquakes, to characterize the ground motion excitation, to analyze the response of elastic single- and multiple-degree-of-freedom systems to earthquake excitation, to use the concept of response and design spectrum, to compute the equivalent seismic loads on simple structures, and to perform code-based seismic design of simple structures. Basic knowledge of Matlab is strongly recommended.

Course Conduct

Two 45-minute lectures will be offered per week. Lecture topics and dates are outlined in the attached Lecture Plan.

Students will be examined in one written examination at the end of the semester. This examination will cover the entire material presented in this course. This examination is scheduled for the last week of the semester and is binding. The examination is offered once per course offering: repetition is not possible without re-enrolling in the course the next time it is offered.

To pass this course a student must pass the written examination.

Resources

The electronic copies of the learning material will be uploaded to eDoZ and available through myStudies. This will include the lecture notes, additional reading, and exercise problems and

solutions.

There is no textbook for this course.

Reading Material

- Jack R Benjamin, C. Allin Cornell (2014) Probability, Statistics, and Decision for Civil Engineers.
- A. H-S. Ang, W. H. Tang Probability Concepts in Engineering: Emphasis on Applications to Civil and Environmental Engineering.
- P.E. Pinto, R. Giannini and P. Franchin (2004) Seismic reliability analysis of structures, IUSSPress. Pavia.
- McGuire, R.K. 2004. Seismic hazard and risk analysis: EERI Monograph MNO-10, Earthquake Engineering Research Institute.
- A Mc. Neil, R. Frey and P. Embrechts, Quantitative Risk Management, Concepts, Techniques and Tools, Princeton University Press, 2015.
- Rees, A. Wambach, The Microeconomics of Insurance, Foundations and Trends in Microeconomics, Vol. 4 , Mps. 1-2 (2008), pp. 1- 163.
- Earthquake Engineering: From Engineering Seismology to Performance-Based Engineering, Yousef Borzorgnia and Vitelmo Bertero, Eds., CRC Press, 2004.

Software

Matlab MathWorks

Office hours

Tuesday 13:00-14:00. Marco Broccardo, HIT F43, e-mail: bromarco@ethz.ch