

Vorlesungsverzeichnis

M.Sc. Natural hazards and risk in structural engineering

Sommer 2025

Stand 23.09.2025

M.Sc. Natural hazards and risk in structural engineering	3
Applied mathematics and stochastics for risk assessment	3
Disaster management and mitigation strategies	3
Earthquake engineering and structural design	3
Finite element methods and structural dynamics	4
Geo- and hydrotechnical engineering	4
Geographical Information Systems (GIS) and building stock survey	5
Life-lines engineering	5
Primary hazards and risks	5
Structural engineering	5
Structural parameter survey and evaluation	6
Special Project	7
Elective compulsory modules	7
Elective Modules	14
Prüfungen	16

M.Sc. Natural hazards and risk in structural engineering**Applied mathematics and stochastics for risk assessment****Disaster management and mitigation strategies****Earthquake engineering and structural design****202002 Earthquake engineering and structural design (L + E + P)****J. Schwarz, L. Abrahamczyk, C. Kaufmann, S. Beinersdorf, H. Verantst. SWS: 6****Maiwald****Vorlesung**

1-Gruppe Mo, wöch., 17:00 - 18:30, Marienstraße 7 B - Seminarraum 205, NHRE - Group A
 1-Gruppe Mo, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 301, NHRE - Group A
 2-Gruppe Mo, wöch., 17:00 - 18:30, Marienstraße 7 B - Seminarraum 106, NHRE - Group B
 2-Gruppe Mo, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 302, NHRE - Group B
 3-Gruppe Do, wöch., 17:00 - 18:30, Marienstraße 7 B - Seminarraum 205, NHRE - Group C
 3-Gruppe Do, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 301, NHRE - Group C
 Do, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal D, Lecture
 Do, wöch., 15:15 - 16:45, Marienstraße 13 C - Hörsaal D, Lecture * Dates by arrangement
 Do, wöch., 15:15 - 16:45, Marienstraße 7 B - Projektraum 301, Exercise * Dates by arrangement

Beschreibung

Students are trained and qualified in tasks of earthquake engineering, natural hazard and risk determining parameters. Students will be able to process input data, to realize design decision for structures of different building type and risk potential, to apply modern building codes and design concepts, to develop earthquake resistant structures and to evaluate structural design.

Earthquake engineering

Seismic Code development and generations; simplified analysis methods; design of structures and regularity criteria for earthquake resistance; performance and experience-based design concepts; rules for engineered buildings (R/C, steel, masonry) and non-engineered buildings; interaction effects between structure and soil, equipment and filling media; special and high risk structures

Structures in Earthquake Regions

Description of National code development; recent code situation; determination of seismic forces for an idealized RC frame system; comparison of different international code levels

Design of RC frames with masonry infill walls in earthquake regions: Application of modern software tools

Training of modelling and calculation with different software tools; interpretation of structural systems in terms of earthquake resistance design (ERD); design and analysis of structural systems for given and modified building layouts; comparison of the results with outcome of damage surveys. Tools: ETABS, SAP2000

Voraussetzungen

recommended module "Primary Hazards and Risks" NHRE

Leistungsnachweis**1 written exam**

"Earthquake engineering" / 180 min (67%) / **SuSe** + **WiSe**

1 Project report + Project presentation

"Structures in Earthquake Regions/Design of RC frames" /

(33%) / **SuSe**

Finite element methods and structural dynamics

Geo- and hydrotechnical engineering

202003 Geo- and hydrotechnical engineering - Part: "Flood hazard and vulnerability assessment" (L + E)

H. Maiwald, S. Beinersdorf

Veranst. SWS: 3

Vorlesung

Di, wöch., 15:15 - 16:45, Marienstraße 13 C - Hörsaal D

Do, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal D, Dates by arrangement

Beschreibung

The students should be able to apply the strategies and methods to arbitrary engineering problems in the given fields. To fix the theoretical background the student has to apply the methods independently at given tasks during several projects.

Flood Hazard and Vulnerability Assessment

Flood Management; Fundamentals of flood defence; Management of low-lying areas; Design of river dikes, channels and dams; Design concepts for the defence of structural objects and buildings; Forecasting, management and maintenance in flood defence; Hydrology, hydraulic calculations, flood routing; Characteristics of tsunami action, forces and loads on structures; Structural damage and loss prediction, damage scenarios; Re-interpretation of recent events.

Bemerkung

Vorlesungen in englischer Sprache "Flood hazard and vulnerability assessment"

Leistungsnachweis

1 written exam

"Flood Hazard and Vulnerability Assessment" / 90 min (50%)

/ **SuSe** + WiSe

906014 Geo- and hydrotechnical engineering - Part: "Geotechnical Engineering" (L + E)

P. Staubach, C. Rodríguez Lugo

Veranst. SWS: 3

Vorlesung

Mi, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal D

Fr, wöch., 15:15 - 16:45, Marienstraße 13 C - Hörsaal D, Dates by arrangement

Beschreibung

The objective of this module is focused on deepening the basics of soils mechanics, the fundamentals of analysis in applications for static and dynamic analysis as well as the basics of soil-structure interaction analysis. The students

should be able to apply the strategies and methods to arbitrary engineering problems in the given fields. To fix the theoretical background the student has to apply the methods independently at given tasks during several projects.

Geotechnical Engineering

Classification and identification of soils; Description of soil state; Water in the soil; Hydraulic conductivity and seepage flow; Distribution of vertical stress in the soil; Stress-strain relationships; Settlement analysis; Consolidation theory; Shear strength; Earth pressure; Basics of Soil Dynamics (wave propagation, laboratory and field testing, soil-structure interaction under dynamic loading); Soil Liquefaction (phenomenon, consequences, estimation of liquefaction risk, prevention)

Leistungsnachweis

1 written exam

"Geotechnical Engineering" / 90 min (50%) / **SuSe** + WiSe

Geographical Information Systems (GIS) and building stock survey

Life-lines engineering

Primary hazards and risks

Structural engineering

205013, 205033 **Structural engineering - Steel structures (L)**

M. Kraus, S. Ibañez Sánchez

Veranst. SWS: 3

Vorlesung

Di, Einzel, 17:00 - 18:30, Marienstraße 13 C - Hörsaal C, 15.04.2025 - 15.04.2025

Di, Einzel, 17:00 - 18:30, Marienstraße 13 C - Hörsaal C, 13.05.2025 - 13.05.2025

Mo, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal D

Di, wöch., 17:00 - 18:30, Marienstraße 7 B - Seminarraum 205

Di, wöch., 17:00 - 18:30, Marienstraße 13 C - Hörsaal D

Beschreibung

Students will be familiar with the history of structures and structural forms, with building materials and building methods. They will understand the concepts of structural engineering design, including safety concepts, loads and structural design codes. They will be able to convert a structural concept into a mechanical model to determine internal demand and to design and detail the components of the structure, with an emphasis on reinforced concrete and post-tensioned concrete structures as well as steel and steel-concrete composite structures.

Structural Engineering – Advanced systems (summer semester):

Design of steel and steel-concrete composite structures; Post-tensioned concrete structures – design and detailing; Design of steel connections and detailing

Voraussetzungen

B.Sc.

Leistungsnachweis

2 written exams

"Reinforced and post-tensioned concrete structures" / 90 min (50%) / **WiSe** + SuSe --> WiSe!

"Steel structures" / 90 min (50%) / **SuSe** + WiSe

Structural parameter survey and evaluation

204018 **Structural parameter survey and evaluation (L + E + P)**

G. Morgenthal, V. Rodehorst, B. Rüffer, T. Gebhardt, S. Rau, M. Schönlein

Veranst. SWS: 4.5

Vorlesung

Fr, Einzel, 09:15 - 12:30, Marienstraße 13 C - Hörsaal C, 11.04.2025 - 11.04.2025

Fr, wöch., 09:15 - 12:30, Marienstraße 13 C - Hörsaal D

Fr, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal D

Beschreibung

The students will be familiar with methods to determine properties of structural systems by means of modern measurement techniques. They will be familiar with the concepts, the application and the limitations of these techniques. They understand the data obtained and the methods to condition, analyse and interpret the data to extract information about structures and structural members and components. They will be able to apply the concepts to develop measurement setups and analysis procedures to problems encountered in structural engineering.

Signal Analysis

Trigonometric polynomials (TP); amplitude-phase and complex representation; approximation of arbitrary periodic functions by TP using method of least squares, calculation of Fourier coefficients and error estimation; Fourier series. Discussion of spectra and Fourier transform and its basic properties; Convolution and its properties and applications; random variables and central limit theorem; applications of Fourier transforms such as filtering of signals and solving differential equations

Sensor-based Monitoring and System Analysis

Types and principles of sensors; important sensor properties; data acquisition techniques; spectral and stochastic analysis of sensor data; properties of structural systems important in experimental testing and structural health monitoring; relevant limit states; structural analysis, modelling and model calibration; applications to static and dynamic response, load determination, physically nonlinear structural behaviour and optimization of sensor system setups

Geo-spatial Monitoring

Preparation and planning of three-dimensional measurement tasks; application of tacheometry, satellite-based positioning (GNSS), terrestrial laser scanning and photogrammetry for monitoring; image-based sensor orientation and surface reconstruction; spatial transformations, georeferencing, distance measures, pointcloud registration and geometric deformation analyses

Voraussetzungen

Primary hazards and risks

Applied mathematics

Leistungsnachweis

1 written exam

"Structural parameter survey and evaluation" / 120 min

(100%) / SuSe + WiSe

Special Project

Elective compulsory modules

2401012 Applied Finite element methods (Lecture)

T. Rabczuk, C. Könke, J. Lopez Zermeño, L. Nguyen Tuan Veransth. SWS: 2
Vorlesung
Do, wöch., 07:30 - 09:00, Marienstraße 7 B - Seminarraum 205

2401012 Applied Finite element methods (Exercise)

T. Rabczuk, J. Lopez Zermeño, F. Tartaglione Garcia Veransth. SWS: 1
Seminar
Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 302, Exercise
Mi, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 301, Tutorium
Mi, wöch., 13:30 - 15:00, Marienstraße 7 B - Seminarraum 205, Tutorium

303001 Advanced Building Information Modelling

C. Koch, J. Krischler, J. Taraben Veransth. SWS: 4
Vorlesung
Mi, wöch., 11:00 - 12:30, Marienstraße 7 B - PC-Pool Luna-red, Exercise
Mi, wöch., 11:00 - 12:30, Coudraystraße 13 B - Pool Fak. B 007, Exercise
Mi, wöch., 11:00 - 12:30, Coudraystraße 11 C - Pool-Raum 101, Exercise
Do, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal A, Lecture

engl. Beschreibung/ Kurzkomentar

Advanced Building Information Modelling

Content: Advanced geometric and parametric modelling, Interoperability and collaboration concepts (IFC, IDM, BEP), Advanced use cases (e.g. clash detection, as-built model-ing), BIM programming (incl. visual programming)

Target qualifications: This module introduces advanced concepts of Building Information Modelling (BIM) to provide students with advanced knowledge in order to understand, analyze and discuss scientific research approaches related to BIM. Within the frame of the mod-ule project (coursework) the students will choose a topic from a pre-defined list or come up with their own topic. Based on that they will do detailed research, imple-ment a representative concept in a software prototype and discuss findings and limi-tations. Also the students acquire skills of scientific working and presentation.

Bemerkung

NHRE: Possible as Elective Compulsory as from Intake 2022

Voraussetzungen

Recommended require-ments for participation: Basic knowledge of Computer-Aided Design, BIM concepts, and object-oriented programming

Leistungsnachweis

written report, presentation

204031 Computational and Experimental Wind Engineering (L, E, P)

G. Morgenthal, S. Chawdhury, G. Tondo

Veranst. SWS: 6

Vorlesung

Mi, wöch., 11:00 - 12:30, Marienstraße 7 B - Seminarraum 205

Mi, wöch., 11:00 - 12:30, Marienstraße 7 B - Projektraum 301

Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Seminarraum 205

Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 301

Beschreibung

The course aims to introduce the students to the fundamentals and state-of-the-art methods of wind engineering and different aerodynamic phenomena that are relevant to the design of long-span cable-supported bridges. To characterize and quantify aerodynamic and aeroelastic effects, students will understand the concepts of computational fluid dynamics (CFD) simulations and experimental wind tunnel tests, along with their advantages and limitations. Students will be able to model complex bridge structures using Finite Element Analysis methods and simulate dynamic response due to wind. Different combinations of analytical, numerical and experimental analysis approaches are employed to investigate dynamic wind excitations with a focus on identifying serviceability issues and ultimate limit scenarios of the structure.

Participating students are tasked with practical bridge design-oriented challenges and work in groups to address them. Group organization and goal-oriented work are an important aspect to the project work. Results are reported periodically in presentations. Results are to be summarized in a report following scientific writing standards and presented orally.

Bemerkung

Literature review on aerodynamic phenomena in long-span bridges; Fundamentals of computational wind engineering; Aerodynamic loads; Self-excited or motion-induced forces; Aerodynamic instabilities; Finite Element modelling and dynamic simulation of long-span bridges (arches, cable-stayed bridges, suspension bridges); Model Validation; Analytical and semi-analytical aerodynamic models; 2D and pseudo-3D CFD simulations; Developing experimental scaled models; Experimental wind tunnel testing; Comparison of results from different methods; Strategies for vibration mitigation; Aerodynamic optimization; Scientific writing and design-focused reporting.

Leistungsnachweis

1 Intermediate presentation

"Theoretical background and work update (20%)" / SuSe

1 Final presentation

"Presentation of final outcome (30%)" / SuSe

1 Final report

"Computational and Experimental Wind Engineering for Long-

span Bridge Design" (50%) / SuSe

301016 Complex dynamics**B. Rüffer**

Veranst. SWS: 4

Vorlesung

Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Seminarraum 102

Fr, wöch., 09:15 - 10:45, Marienstraße 7 B - Seminarraum 102

Beschreibung

After the course the students will be able to analyse mathematical models that describe dynamic behaviour, as they occur in engineering (e.g. mechanical coupling of building structures), in biology and in physics, but also in multi-agent systems in computer science, or as opinion dynamics in psychology. Based on examples from different disciplines, students learn to build simplified models that allow to answer questions on their long-term behaviour. Students will be able to apply methods of feedback design that help shape the dynamics of a given system, along with the relevant stability concepts. As several topics lend themselves for computer simulation, students of this course will develop a proficiency to both implement and analyse mathematical models using computational tools and software.

Bemerkung

Examples of complex dynamics. Models for dynamical systems in continuous and discrete time. Computer simulation. Control and Feedback. Stability, stabilization, and Lyapunov functions. Coupled systems: Disturbance or Cooperation? Networks of systems. Consensus. Synchronization.

The topics will be presented in a lecture, deepened by exercises. Some of the exercise include computer programming and simulation.

Voraussetzungen

B.Sc., knowledge in Matlab or Python

Leistungsnachweis**1 oral exam**

"Complex dynamics"

30 min (100%) / **SuSe** + WiSe

401009 Experimental structural dynamics and Structural monitoring (P)**T. Most, R. Das, F. Tartaglione Garcia**

Veranst. SWS: 4

Projekt

Mi, Einzel, 15:15 - 16:45, Marienstraße 13 C - Hörsaal C, guest lecture Prof. Zabel, 25.06.2025 - 25.06.2025

Mo, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 301

Mi, wöch., 15:15 - 16:45, Marienstraße 7 B - Projektraum 301

Beschreibung

The students obtain deepened knowledge in structural dynamics, structural dynamic analysis, data processing, dynamic test equipment and its handling. They learn to analyse the dynamic behaviour of a structure utilizing both numerical and experimental state-of-the-art methods. Furthermore, the students have to develop strategies and concepts of investigation. The work in small groups enhances the social competence of the students.

Operational modal analysis, sensor types, sensor positioning, data analysis and assessment, assessment of structural changes, structural modelling, model updating

Bemerkung

14 students from NHRE only

Voraussetzungen

Structural dynamics

Leistungsnachweis

1 Project report + intermediate and final presentations

„ Experimental structural dynamics“

(100%) / **SuSe**

451002 Introduction to Optimization (L+E)

T. Lahmer

Veranst. SWS: 3

Integrierte Vorlesung

Mo, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B, Lecture

Di, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301, Exercise Dates by arrangement

Beschreibung

In engineering science, we are often faced with problems having potential for optimization. We learn how to formulate this in mathematical terms, and we will study techniques how to improve the situations, generally by involving numerical models. We will discuss classical optimization problems in the field of linear and nonlinear optimization, e.g. optimization of the use of resources, routing problems, calibration problems and structural optimization. In particular in structural optimization we learn techniques like dimensioning, shape and topology optimization. Optimized structures are discussed also in the context of additive manufacturing techniques.

Bemerkung

Introduction to Optimization (summer semester):

Definitions, Classification of Optimization Problems,

Linear Problems, Simplex Method, Nonlinear Problems: Constrained and unconstrained continuous problems, descent methods and variants. (Robust) Structural Optimization (including Shape and Topology Optimization)

Voraussetzungen

B.Sc.

Leistungsnachweis

1 written or oral exam (depending on the number of participants)

"Introduction to Optimization" (3 credits) / **SuSe + WiSe**

202004 Multi-hazard and risk assessment (L + E)

**J. Schwarz, S. Beinersdorf, H. Maiwald, N. Hadidian
Moghaddam, P. Hasan**

Veranst. SWS: 4

Vorlesung

Di, Einzel, 13:30 - 15:00, Marienstraße 13 C - Hörsaal B, lecture Prof. Cotton, 20.05.2025 - 20.05.2025

Di, Einzel, 15:15 - 16:45, Marienstraße 13 C - Hörsaal B, lecture Prof. Cotton, 20.05.2025 - 20.05.2025

Di, Einzel, 15:15 - 16:45, Marienstraße 7 B - Seminarraum 205, exercise Dr Weatherill, 27.05.2025 - 27.05.2025

Mo, wöch., 15:15 - 16:45, Marienstraße 7 B - Seminarraum 205

Di, wöch., 13:30 - 15:00, Marienstraße 7 B - Seminarraum 205

Beschreibung

The students will be familiar with the probability of natural hazard and risk determining parameters. They will be able to recognize procedures of single and multi-hazard assessment and to process input data and to apply tools to study areas. Students will be introduced in further advanced geotechnologies and existing or on-going research as well as global projects conducted by GFZ.

Hazard Assessment and Applications

Primary input and output parameters for EQ (and other natural) hazard; Earthquake statistics and occurrence probability; Methodology of seismic hazard assessment; Seismicity models; Examples of seismic hazard and risk studies; Synopses of natural hazards; procedures and developments in multi-hazard assessment; Case studies of multi-hazard, vulnerability, and risk considerations.

Workshop

"Natural Hazards and Advanced Geotechnologies" during excursion to GFZ Potsdam

Compilation of EQ hazard-related data

Treatment of long-term seismicity data files; elaboration of earthquake data to get harmonized input for PSHA; earthquake catalogues; creation of shakemaps; data pre-processing; Hazard Description for the Project regions

Bemerkung

In this course 20 students can take part. **It is compulsory for the DAAD-scholarship holders of NHRE intake 2024.** There will be an introduction to the module at April 8th, where everybody interested can participate.

If you are interested to take part in the course, please write a **proposal** why you are interested and what are the major problems in your country related to multi-hazard that you identified yourself. Please **submit this to silke.beinersdorf@uni-weimar.de until April 4th, 2025.** We will inform you about the decision until April 7th, 2025.

The excursion to Berlin and Potsdam will take place this semester. **As soon as you are accepted, you will be enrolled to the moodle-room.**

Voraussetzungen

recommended module "Primary Hazards and Risks" (NHRE)

completion of the module "Geographical information systems (GIS) and building stock survey" (NHRE) or basic knowledge of GIS-Systems is also recommended

Leistungsnachweis

1 written exam

"Multi-Hazard and risk assessment" / 90 min

(50%) / **SuSe** + WiSe

1 Project report (SYMULTHAN)

(50%) / **SuSe**

B. Rüffer, M. Schönlein

Veranst. SWS: 4

Vorlesung

Do, wöch., 13:30 - 15:00, Coudraystraße 13 B - Hörsaal 3

Fr, wöch., 13:30 - 15:00, Coudraystraße 13 B - Hörsaal 3

Beschreibung

After the course the students will be familiar with the fundamental concepts of data science. The participants can analyse given data sets with respect to dimensionality reduction and clustering. They also know the basic structure of neural networks and support vector machines to solve classification tasks. The participants know relevant methods from linear algebra and optimization and can apply these techniques. This embraces the design of appropriate algorithms and the implementation of different numerical methods to solve the corresponding problems.

Bemerkung

linear regression, logistic regression, dimension reduction, principle component analysis, linear discriminant analysis, multidimensional scaling, k-means clustering, support vector machines, kernel methods, neural networks, natural language processing

Voraussetzungen

B. Sc.; Analysis and Linear Algebra at Bachelor level, knowledge of Matlab or Python

Leistungsnachweis**1 oral exam**

"Mathematics for data science"

30 min (100%) / **SuSe** + WiSe

451006 Optimization in Applications (P)

T. Lahmer

Veranst. SWS: 3

Projektmodul/Projekt

Beschreibung

In engineering science, we are often faced with problems having potential for optimization. We learn how to formulate this in mathematical terms, and we will study techniques how to improve the situations, generally by involving numerical models. We will discuss classical optimization problems in the field of linear and nonlinear optimization, e.g. optimization of the use of resources, routing problems, calibration problems and structural optimization. In particular in structural optimization we learn techniques like dimensioning, shape and topology optimization. Optimized structures are discussed also in the context of additive manufacturing techniques.

Bemerkung**Optimization in Applications (summer semester):**

Optimization in Applications is generally a project assigned to the students including own programming and modelling. E.g. innovative optimization strategies are to be implemented in Matlab, Python or similar. Alternatively, engineering models could be subjected to optimization software.

Leistungsnachweis

1 project "Optimization in Applications" (3 credits) / **SuSe** + WiSe

451007 Stochastic Simulation Techniques and Structural Reliability (L+E)

T. Lahmer

Veranst. SWS: 3

Integrierte Vorlesung

Di, wöch., 09:15 - 10:45, Coudraystraße 11 C - Pool-Raum 101, Exercise dates by arrangement

Di, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal D, Lecture

Beschreibung

Soils, rocks and materials like concrete are in the natural state among the most variable of all engineering materials. Engineers need to deal with this variability and make decisions in situations of little data, i.e. under high uncertainties. The course aims in providing the students with techniques state of the art in risk assessment (structural reliability) and stochastic simulation.

The course topics comprise

- (a very brief review) of probability theory
- discrete and continuous random processes and fields
- estimation of statistical parameters
- stochastic simulation techniques (Monte Carlo Samplings)
- reliability-based design
- sensitivity analysis
- structural safety
- Risk assessment and stochastic modelling in practice

Bemerkung

The lecture consists of weekly lectures by Prof. Tom Lahmer (Bauhaus University Weimar) throughout the semester and an intensive practical training (Blockkurs) on applications by Dr. Thomas Most (DYNARDO, Weimar). Please indicate your interest in the course via an E-Mail to Prof. Tom Lahmer (tom.lahmer@uni-weimar.de) by briefly citing the title of the lecture and providing your name until **April 1st** as this will make the organization of rooms, course material, etc. much easier.

Possible combinations with other lectures acc. to the NHRE-Modulguide.

Voraussetzungen

Basic knowledge in probability theory

Leistungsnachweis

1 written or oral exam (depending on the number of participants)

"Stochastic Simulation Techniques and Structural Reliability" / (50%) / **SuSe** + WiSe

451011 Stochastic Simulation Techniques and Structural Reliability (P)
T. Lahmer

Veranst. SWS: 3

Projektmodul/Projekt

Beschreibung

The course topics comprise

- (a very brief review) of probability theory
- discrete and continuous random processes and fields
- estimation of statistical parameters
- stochastic simulation techniques (Monte Carlo Simulation)
- reliability-based design
- sensitivity analysis

- structural reliability (FORM, FOSM, Subset Simulation, ...)
- Risk assessment and stochastic modelling in practice

The project (extra 3 credits) involves own programming of stochastic simulation algorithms, e.g. generators of random fields, methods to assess structural reliability, and combination of stochastic simulation techniques with engineering models.

Bemerkung

Possible combinations with other lectures acc. to the [NHRE-Moduleguide](#).

Voraussetzungen

Basic knowledge in probability theory

Leistungsnachweis

1 written or oral exam (depending on the number of participants)

"Stochastic Simulation Techniques and Structural Reliability" / (50%) / **SuSe** + WiSe

Elective Modules

Seit Wintersemester 2018/19 besteht an der Bauhaus-Universität Weimar ein zusätzliches Angebot an fächerübergreifenden Lehrveranstaltungen im Rahmen der Bauhaus.Module. **Studierende des NHRE können Bauhaus.Module aus dem Bereich Master belegen.** Inwiefern diese Module des **Wahlbereichs** ersetzen können, muss individuell mit der Fachstudienberatung geklärt werden. Das Angebot der Bauhaus.Module findet sich unter weimar.de/bauhausmodule.

Bemerkung:

- nur Masterkurse der BUW
- besonders engl. Kurse

Wunsch nach Einteilung der BM im bison nach Sprachen

303002 Simulation Methods in Engineering

C. Koch, M. Artus

Veranst. SWS: 4

Vorlesung

Mi, Einzel, 14:00 - 15:30, Steubenstraße 6, Haus F - Hörsaal K20, 06.08.2025 - 06.08.2025

Mi, Einzel, 14:00 - 15:30, Marienstraße 13 C - Hörsaal A, 06.08.2025 - 06.08.2025

Fr, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal A

Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 301

Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 302

engl. Beschreibung/ Kurzkomentar

Simulation Methods in Engineering

Content:

- System analysis and modelling
- System dynamics
- Discrete event simulation
- Multi-agent simulation
- Input data and stochastic simulation
- Simulation based optimization
- Introduction to the software AnyLogic

Target qualifications:

This module provides students with comprehensive knowledge about computer based simulation concepts to address practical challenges in engineering. Modern simulation and optimization software is introduced within tutorials. The module project (coursework) offers an opportunity to students to work in groups on current problems in the context of civil and environmental engineering (e.g. production logistics, pedestrian simulation, pollutant dispersion). Using object-oriented simulation software the students will analyze, model and simulate different engineering systems. The programming is carried out using Java. Also the students acquire team working and presentation skills.

Voraussetzungen

Recommended requirements for participation: Basic knowledge of programming

Leistungsnachweis

Short group report, group presentation, written exam

302014 Indoor Environmental Modeling

C. Völker, H. Alsaad

Veranst. SWS: 4

Integrierte Vorlesung

Mo, Einzel, 13:00 - 16:00, exam, 14.07.2025 - 14.07.2025

Mo, wöch., 13:30 - 16:45, Coudraystraße 13 B - Pool Fak. B 007, Vorlesung

Beschreibung

Das Modul führt in die Untersuchung und Bewertung des Raumklimas ein, wobei der Schwerpunkt auf den Simulations- und Validierungsaspekten dieses Themas liegt. Die Studierenden lernen die Grundlagen des Raumklimas, die Methoden der raumklimatischen Modellierung und die für die Validierung der Simulationen notwendigen empirischen Messungen kennen. Dieses Modul beinhaltet einen Gruppenbeleg, in dem die Studierenden zunächst empirische Messungen in den Laboren der Professur Bauphysik durchführen und diese Experimente anschließend mit Hilfe der Strömungssimulation modellieren. Die Simulationen werden anhand der Messungen validiert. Durch diese Aufgaben lernen die Studierenden die notwendigen Fähigkeiten für wissenschaftliche Forschung, fortgeschrittene Simulationswerkzeuge, wissenschaftliches Schreiben, Präsentation und Teamarbeit.

Bemerkung

Die Veranstaltung ist auf eine **Gesamt-Teilnehmerzahl von 12** begrenzt.

Voraussetzungen

Es ist kein Abschluss in einer vorhergehenden Lehrveranstaltung notwendig.

Kenntnisse in den Grundlagen der numerischen Analyse, FEM, FVM oder ähnlichem werden für die Teilnahme vorausgesetzt

Leistungsnachweis

Beleg, Präsentation und mündliche Prüfung

325130019 Robotic Tectonics II: Design for Robotic Assembly - Negotiating Computation, Tectonics and Fabrication

J. Willmann, L. Abrahamczyk, M. Braun, M. Haweyou, KuG

Veranst. SWS: 2

Wissenschaftsmodul

Fr, wöch., 11:00 - 13:00, Raum: D-LAB (Geschwister-Scholl-Straße 13), ab 25.04.2025

Beschreibung

Die Veranstaltung findet auf Englisch statt. Über die Sprachumschaltflagge (oben rechts) gelangen Sie zur englischsprachigen Beschreibung.

Bemerkung

Bitte beachten Sie die entsprechende Studienordnung.

Prüfungen

202002 Exam: Earthquake engineering and structural design

L. Abrahamczyk, J. Schwarz

Prüfung

Di, Einzel, 14:00 - 17:00, Marienstraße 13 C - Hörsaal B, Final examination Surname -> all students, 22.07.2025 - 22.07.2025

Di, Einzel, 14:00 - 17:00, Marienstraße 13 C - Hörsaal D, Final examination -> not used for exam, 22.07.2025 - 22.07.2025

202003 Exam: Geo- and hydrotechnical engineering - Part: "Flood hazard and vulnerability assessment"

H. Maiwald, J. Schwarz

Prüfung

Do, Einzel, 10:45 - 12:15, Marienstraße 13 C - Hörsaal B, Final examination Surname '.' to letter 'N', 24.07.2025 - 24.07.2025

Do, Einzel, 10:45 - 12:15, Marienstraße 13 C - Hörsaal D, Final examination Surname 'P' to letter 'Y', 24.07.2025 - 24.07.2025

204018 Exam: Structural parameter survey and evaluation

G. Morgenthal, V. Rodehorst, B. Rüffer

Prüfung

Fr, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal B, Final examination, 08.08.2025 - 08.08.2025

Fr, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal D, Final examination, 08.08.2025 - 08.08.2025

205033 Exam: Structural engineering - Steel structures

M. Kraus

Prüfung

Mo, Einzel, 09:00 - 10:30, Steubenstraße 6, Haus F - Hörsaal K20, Final examination, 04.08.2025 - 04.08.2025

906014 Exam: Geo- and hydrotechnical engineering - Part: "Geotechnical Engineering"

P. Staubach, C. Rodríguez Lugo

Prüfung

Di, Einzel, 13:00 - 14:30, Marienstraße 13 C - Hörsaal B, Final examination, 29.07.2025 - 29.07.2025

Di, Einzel, 13:00 - 14:30, Marienstraße 13 C - Hörsaal D, Final examination, 29.07.2025 - 29.07.2025

202004 Exam: Multi-hazard and risk assessment

J. Schwarz, S. Beinersdorf, H. Maiwald

Prüfung

Do, Einzel, 09:00 - 10:30, Marienstraße 13 C - Hörsaal D, Final examination, 31.07.2025 - 31.07.2025

Beschreibung

The students will be familiar with the probability of natural hazard and risk determining parameters. They will be able to recognize procedures of single and multi hazard assessment and to process input data and to apply tools to study areas. Students will be introduced in further advanced geotechnologies and existing or on-going research as well as global projects conducted by GFZ.

Hazard Assessment and Applications

Primary input and output parameters for EQ (and other natural) hazard; Earthquake statistics and occurrence probability; Methodology of seismic hazard assessment; Seismicity models; Examples of seismic hazard and risk studies; Synopses of natural hazards; procedures and developments in multi-hazard assessment; Case studies of multi-hazard, vulnerability and risk considerations.

Workshop

"Natural Hazards and Advanced Geotechnologies" --> due to the current situation, we will be not able to conduct the excursion - this part will be replaced by: Multi-hazard study of your home country and building stock survey

Compilation of EQ hazard-related data

Treatment of long term seismicity data files; elaboration of earthquake data to get harmonized input for PSHA; earthquake catalogues (for the countries of the participants and adjacent regions); data pre-processing; Hazard Description for the Project regions

Excursion to GeoResearchCenter Potsdam --> the recent situation might allow to have the excursion this year

Bemerkung

In this course 28 students can take part. **It is compulsory for the DAAD-scholarship holders of NHRE intake 2021.** There will be an introduction to the module at April 4th, where everybody interested can participate.

If you are interested to take part in the course, please write a **proposal** why you are interested and what are the major problems in your country related to multi-hazard that you identified yourself. Please **submit this to silke.beinersdorf@uni-weimar.de until April 4th, 2022.** We will inform you about the decision until April 8th, 2022.

The excursion to Potsdam might take place this semester.

As soon as you are accepted, you will be enroled to the moodle-room.

Voraussetzungen

recommended module "Primary Hazards and Risks" (NHRE)

completion of the module "Geographical information systems (GIS) and building stock survey" (NHRE) or basic knowledge of GIS-Systems is also recommended

Leistungsnachweis

1 written exam

"Multi-Hazard and risk assessment" / 90 min

(50%) / **SuSe** + **WiSe**

1 Project report (SYMULTHAN)(50%) / **SuSe****205007 Exam: Modelling of steel structures and numerical simulation****M. Kraus**

Prüfung

Mi, Einzel, 09:00 - 11:00, Final examination Meeting Room SHS, 06.08.2025 - 06.08.2025

Bemerkung**301016 Exam: Complex dynamics****B. Rüffer**

Prüfung

Mi, Einzel, 09:00 - 17:00, Final examination - oral exam (organized by chair) --> please contact the responsible, 30.07.2025 - 30.07.2025

301017 Exam: Mathematics for data science**B. Rüffer, M. Schönlein**

Prüfung

Mi, Einzel, 09:00 - 17:00, Final examination - oral exam (organized by chair) --> please contact the responsible, 30.07.2025 - 30.07.2025

Beschreibung

After the course the students will be familiar with the fundamental concepts of data science. The participants can analyse given data sets with respect to dimensionality reduction and clustering. They also know the basic structure of neural networks and support vector machines to solve classification tasks. The participants know relevant methods from linear algebra and optimization and can apply these techniques. This embraces the design of appropriate algorithms and the implementation of different numerical methods to solve the corresponding problems.

Bemerkung

linear regression, logistic regression, dimension reduction, principle component analysis, linear discriminant analysis, multidimensional scaling, k-means clustering, support vector machines, kernel methods, neural networks, natural language processing

Voraussetzungen

B. Sc.; Analysis and Linear Algebra at Bachelor level, knowledge of Matlab or Python

Leistungsnachweis**1 oral exam**

"Mathematics for data science"

30 min (100%) / **SuSe** + WiSe

303001 Exam: Advanced building information modeling

C. Koch

Prüfung

Do, Einzel, 13:00 - 15:00, Steubenstraße 6, Haus F - Hörsaal K20, Final examination, 31.07.2025 - 31.07.2025

Do, Einzel, 13:00 - 15:00, Marienstraße 13 C - Hörsaal A, Final examination, 31.07.2025 - 31.07.2025

401012 Exam: Finite element methods and structural dynamics - Part: Applied finite element methods**T. Rabczuk**

Prüfung

Fr, Einzel, 11:00 - 12:30, Marienstraße 7 B - Seminarraum 205, Final examination, 01.08.2025 - 01.08.2025

Bemerkung

Re-examination

451002 Exam: Introduction to Optimization**T. Lahmer**

Prüfung

Fr, Einzel, 13:00 - 14:30, Marienstraße 13 C - Hörsaal B, 25.07.2025 - 25.07.2025

Fr, Einzel, 13:00 - 14:30, Marienstraße 13 C - Hörsaal D, 25.07.2025 - 25.07.2025

451007 Exam: Stochastic Simulation Techniques and Structural Reliability**T. Lahmer**

Prüfung

Fr, Einzel, 13:30 - 15:00, Marienstraße 13 C - Hörsaal B, Final examination, 08.08.2025 - 08.08.2025

Fr, Einzel, 13:30 - 15:00, Marienstraße 13 C - Hörsaal D, Final examination, 08.08.2025 - 08.08.2025

202001 Re-examination: Primary hazards and risks - Part: Seismic monitoring**J. Schwarz**

Prüfung

Fr, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal D, Re-examination, 25.07.2025 - 25.07.2025

Bemerkung

Re-examination

204017 Re-examination: Wind risk mitigation in structural engineering**A. Athanasiou, G. Morgenthal**

Prüfung

Do, Einzel, 13:00 - 14:30, Marienstraße 7 B - Seminarraum 205, Re-examination, 07.08.2025 - 07.08.2025

Bemerkung

Re-examination

204019 Re-examination: Life-lines engineering

G. Morgenthal

Prüfung

Di, Einzel, 13:00 - 16:00, Marienstraße 7 B - Seminarraum 205, Re-examination, 05.08.2025 - 05.08.2025

Bemerkung

Re-examination

2205012, 205032 Re-examination: Structural engineering - Standard systems, until WiSe21/22; Reinforced and post-tensioned concrete structures, from WiSe 22/23

G. Morgenthal

Prüfung

Mo, Einzel, 09:00 - 10:30, Marienstraße 7 B - Seminarraum 205, Re-examination, 21.07.2025 - 21.07.2025

Mo, Einzel, 09:00 - 10:30, Marienstraße 7 B - Seminarraum 206, Re-examination, 21.07.2025 - 21.07.2025

253001 Re-examination: Structural design and performance assessment (for extreme loading conditions)

L. Abrahamczyk, A. Athanasiou

Prüfung

Mo, Einzel, 13:00 - 14:30, Marienstraße 7 B - Seminarraum 205, Re-examination, 21.07.2025 - 21.07.2025

Bemerkung

Re-examination

301012 Re-examination: Applied mathematics and stochastics for risk assessment

B. Rüffer, T. Lahmer

Prüfung

Mo, Einzel, 09:00 - 12:00, Marienstraße 13 C - Hörsaal D, Re-examination, 28.07.2025 - 28.07.2025

Bemerkung

Re-examination

401014 Re-examination: Finite element methods and structural dynamics - Part: Structural Dynamics

T. Most

Prüfung

Mi, Einzel, 09:00 - 10:30, Marienstraße 7 B - Seminarraum 102, Re-examination, 23.07.2025 - 23.07.2025

Bemerkung

Re-examination

401015 Re-examination: Finite element methods and structural dynamics - Part: Finite element methods
T. Rabczuk

Prüfung

Fr, Einzel, 09:00 - 10:30, Marienstraße 7 B - Seminarraum 205, Re-examination, 01.08.2025 - 01.08.2025

Fr, Einzel, 09:00 - 10:30, Marienstraße 7 B - Seminarraum 206, Re-examination, 01.08.2025 - 01.08.2025

Bemerkung

Re-examination

904002 Re-examination: Geographical information systems (GIS) and building stock survey
V. Rodehorst, J. Schwarz, S. Beinersdorf

Prüfung

Mi, Einzel, 09:00 - 10:30, Marienstraße 7 B - Seminarraum 205, Re-examination, 30.07.2025 - 30.07.2025

205014 Re-examination: Design and interpretation of experiments
M. Kraus

Prüfung

Do, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal B, Re-examination, 07.08.2025 - 07.08.2025

Bemerkung

Re-examination

401011 Re-examination: Finite element methods and structural dynamics - Part: Applied structural dynamics
A. Athanasiou

Prüfung

Mi, Einzel, 11:00 - 12:00, Marienstraße 7 B - Seminarraum 104, Re-examination, 23.07.2025 - 23.07.2025

Bemerkung

Re-examination

906016 Re-examination: Secondary hazards and risks, until WiSe 2023/25; Advanced geotechnical engineering , from WiSe 2024/25
P. Staubach

Prüfung

Mi, Einzel, 13:00 - 14:30, Coudraystraße 11 C - Seminarraum (geologische Sammlung) 202, Re-examination, 30.07.2025 - 30.07.2025

Bemerkung

Re-examination