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M.Sc. Natural hazards and risk in structural engineering

Winter 2016/17

Stand 14.03.2017

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**M.Sc. Natural hazards and risk in structural engineering****2500011 Advanced Training Course (Exercise)****K. Gürlebeck, D. Legatiuk**

Veranst. SWS: 2

Übung

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

**Kommentar****Numerical Analysis - Computation**

analytical and numerical solution of ordinary differential equations, numerical analysis for systems of linear algebraic equations, direct and iterative solvers; tool: MATLAB

**CAE**

data structures, object oriented programming and numerical methods;

tool: Java

**Voraussetzungen**

B.Sc.

**Leistungsnachweis**

2 exams (written or oral)

**2500011 Advanced Training Course (Lecture)****K. Gürlebeck**

Veranst. SWS: 2

Vorlesung

Mo, wöch., 09:15 - 10:45, Marienstraße 7 B - Seminarraum 205, 08.12.2014 --&gt; HS 6, C9

**Kommentar****Numerical Analysis - Computation**

analytical and numerical solution of ordinary differential equations, numerical analysis for systems of linear algebraic equations, direct and iterative solvers; tool: MATLAB

**CAE**

data structures, object oriented programming and numerical methods;

tool: Java

**Voraussetzungen**

B.Sc.

**Leistungsnachweis**

2 exams (written or oral)

**Meeting NHRE****J. Schwarz, B. Bode**

Sonstige Veranstaltung

Mo, Einzel, 11:00 - 12:30, Marienstraße 13 C - Hörsaal C, 10.10.2016 - 10.10.2016

Mo, Einzel, 15:15 - 16:45, Marienstraße 7 B - Seminarraum 206, Meeting DAAD Scholarship holders, 05.12.2016 - 05.12.2016

## Wahlpflichtmodul I

## Wahlpflichtmodul II

## Wahlpflichtmodul III

## Earthquake engineering and structural design

### 2340008 Earthquake Engineering

**J. Schwarz**

Veranst. SWS: 6

Vorlesung

Do, wöch., 13:30 - 16:45, Marienstraße 13 C - Hörsaal C, Lecture, ab 13.10.2016

Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 302, Project Group A, ab 20.10.2016

Do, wöch., 11:00 - 12:30, Marienstraße 7 B - Projektraum 302, Project Group B, ab 20.10.2016

Do, Einzel, 13:30 - 16:45, Marienstraße 7 B - Projektraum 302, 01.12.2016 - 01.12.2016

#### Kommentar

Methodologies of hazard and risk assessment, description of seismic action; design principles; building codes; rules for engineered (RC, steel, masonry) and non-engineered buildings; lessons from recent earthquakes; damage analysis and loss estimation (earthquake scenarios), computer exercises on data processing and analysis of RC frame structures, GIS-Tools and application to study areas

#### Leistungsnachweis

Klausur oder mündliche Prüfung

### Exam "Earthquake Engineering"

**J. Schwarz, L. Abrahamczyk**

Prüfung

Di, Einzel, 13:00 - 16:00, Marienstraße 13 C - Hörsaal A, 07.02.2017 - 07.02.2017

## Experimental structural evaluation and rehabilitation

### 2350002 Experimental Structural Evaluation / Experimental Structural Evaluation

**M. Kraus, S. Mämpel**

Veranst. SWS: 2

Integrierte Vorlesung

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

### 2350002 Experimental Structural Evaluation - Model testing for Rehabilitation

**J. Schwarz**

Veranst. SWS: 2

Projekt

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

#### Kommentar

**Model testing for rehabilitation**

Experimental investigation of retrofitting strategies on small scale structural models; testing of elements real scale, derivation of force-displacement relationships,

**Voraussetzungen**

Obligatory moduls of 1<sup>st</sup> and 2<sup>nd</sup> semester

**Leistungsnachweis**

1 exam (written or oral)

**2350002 Experimental Structural Evaluation / Signal Processing and Interpretation****T. Lahmer**

Veranst. SWS: 3

Vorlesung

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

**Kommentar****Experimental Structural evaluation**

Testing facilities and technical equipment; demands on specimens and scaling requirements; arrangement of sensors, application of equivalent forces and ground motion in pseudostatic and dynamic testing; Load and displacement relationship for full-scale testing of structural elements (RC columns, masonry wall); damping devices, prediction of capacity curves and material properties and parameters; recalculation of model calibration

**Voraussetzungen**

Obligatory moduls of 1<sup>st</sup> and 2<sup>nd</sup> semester

**Leistungsnachweis**

1 exam (written or oral)

**Exam "Experimental Structural Evaluation and rehabilitation"****M. Kraus, T. Lahmer, J. Schwarz**

Prüfung

Fr, Einzel, 09:00 - 12:00, Coudraystraße 9 A - Hörsaal 6, 17.02.2017 - 17.02.2017

**Finite element methods****Structural dynamics****2110002 Structural Dynamics / Baudynamik (Exercise)****V. Zabel**

Veranst. SWS: 2

Seminar

1-Gruppe Do, wöch., 07:30 - 09:00, Marienstraße 7 B - Seminarraum 205, Tutorial, ab 27.10.2016

1-Gruppe Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301, Group A

2-Gruppe Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Seminarraum 205, Tutorial, ab 26.10.2016

2-Gruppe Mi, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 301, Group B

**Kommentar**

**Dynamics:** Single and multidegree-of-freedom systems, frequency response function, Impulse response function, Duhamel integral, step-by-step methods, modal analysis, modal superposition, continuous systems, applications;

**Baudynamik:** Ein- und Zweifreiheitsgradsystem, Frequenzgangfunktion, Impulsreaktionsfunktion, Duhamel-Integral, Zeitschrittverfahren, Modalanalyse, modale Superposition, kontinuierliche Systeme, Anwendung.

**Voraussetzungen**

Bachelor Civil Engineering

**Leistungsnachweis**

Klausur oder mündliche Prüfung

## 2110002 Structural Dynamics / Baudynamik (Lecture)

**C. Könke, V. Zabel**

Veranst. SWS: 4

Vorlesung

Do, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal C, 03.11.2016 - 24.11.2016

Do, Einzel, 09:15 - 10:45, Marienstraße 13 C - Hörsaal C, 15.12.2016 - 15.12.2016

Di, wöch., 09:15 - 10:45, Coudraystraße 13 B - Hörsaal 3

Mi, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal C

**Bemerkung**

Start on 25th October 2016

**Kommentar**

**Dynamics:** Single and multidegree-of-freedom systems, frequency response function, Impulse response function, Duhamel integral, step-by-step methods, modal analysis, modal superposition, continuous systems, applications;

**Baudynamik:** Ein- und Zweifreiheitsgradsystem, Frequenzgangfunktion, Impulsreaktionsfunktion, Duhamel-Integral, Zeitschrittverfahren, Modalanalyse, modale Superposition, kontinuierliche Systeme, Anwendung.

**Voraussetzungen**

Bachelor Civil Engineering

**Leistungsnachweis**

Klausur oder mündliche Prüfung

## Exam "Structural Dynamics / Baudynamik"

**V. Zabel**

Prüfung

Do, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 105, 09.02.2017 - 09.02.2017

Do, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 106, 09.02.2017 - 09.02.2017

Do, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 205, 09.02.2017 - 09.02.2017

Do, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 206, 09.02.2017 - 09.02.2017

## Geo- and hydrotechnical engineering

### Exam "Geo- and hydrotechnical engineering/Part: Soil mechanics"

**K. Witt**

Prüfung

Di, Einzel, 09:00 - 11:00, Coudraystraße 11 C - Seminarraum (geologische Sammlung) 202, 14.02.2017 - 14.02.2017

## Geographical Information Systems (GIS) and building stock survey

### 2900003 Geographical information systems (GIS) and building stock survey (Exercise)

**J. Schwarz, S. Beinersdorf**

Veranst. SWS: 2

Seminar

1-Gruppe Mo, wöch., 15:15 - 16:45, Marienstraße 7 B - Projektraum 301, Group A, ab 17.10.2016

2-Gruppe Mo, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 301, Group B, ab 17.10.2016

Mo, Einzel, 15:15 - 18:30, Marienstraße 13 C - Hörsaal B, 10.10.2016 - 10.10.2016

Mo, Einzel, 15:15 - 18:30, Marienstraße 13 C - Hörsaal B, 12.12.2016 - 12.12.2016

Mo, Einzel, 15:15 - 18:30, Marienstraße 13 C - Hörsaal B, 23.01.2017 - 23.01.2017

Mo, Einzel, 15:15 - 18:30, Marienstraße 13 C - Hörsaal B, 30.01.2017 - 30.01.2017

#### Leistungsnachweis

Project report + oral presentation

### 2900003 Geographical information systems (GIS) and building stock survey (Lecture)

**V. Rodehorst**

Veranst. SWS: 2

Integrierte Vorlesung

Di, wöch., 11:00 - 12:30, Coudraystraße 11 C - Seminarraum/Hörsaal 001, ab 18.10.2016

#### Leistungsnachweis

Project report + oral presentation

## Hazard projects and advanced geotechnologies

### Life-lines engineering

#### Exam "Life-lines engineering"

**G. Morgenthal**

Prüfung

Do, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 205, 23.02.2017 - 23.02.2017

Do, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 206, 23.02.2017 - 23.02.2017

## Primary hazards and risks

### 2200008 Primary hazards and risks - Wind Risk Mitigation in Structural Engineering

**J. Schwarz**

Veranst. SWS: 2

Integrierte Vorlesung

Mo, Einzel, 09:00 - 18:30, Marienstraße 13 C - Hörsaal C, 20.02.2017 - 20.02.2017  
 Di, Einzel, 09:00 - 18:30, Marienstraße 13 C - Hörsaal C, 21.02.2017 - 21.02.2017  
 Mi, Einzel, 09:00 - 18:30, Marienstraße 13 C - Hörsaal C, 22.02.2017 - 22.02.2017  
 Do, Einzel, 09:00 - 18:30, Marienstraße 13 C - Hörsaal C, 23.02.2017 - 23.02.2017

**Kommentar**

Wind Risk Mitigation in Structural Engineering

meteorology, stochastic wind effects including aeroelasticity, extreme value analysis; risk chain, storm tracks with high damage accumulation, hazard maps; basics of wind resistant design and environmental planning, wind tunnel technology, monitoring and simulations, risk control (control of exposition, shelter projects, wind effects at new types of infrastructures), examples and applications

**Leistungsnachweis**

1 exam (written or oral - weighting acc. to credit points)

**2234007 Primary hazards and risks - Seismic Monitoring / Regional Ground Motion Prediction and database /**

**J. Schwarz**

Veranst. SWS: 4

Integrierte Vorlesung

Do, Einzel, 17:00 - 18:30, Marienstraße 7 B - Projektraum 302, 17.11.2016 - 17.11.2016  
 Do, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B  
 Do, wöch., 17:00 - 18:30, Marienstraße 13 C - Hörsaal C

**Kommentar**

Seismic Monitoring

measurements for site response evaluation; description of seismic action; recording instruments and input models for seismic hazard assessment; EQ-Action for building design; Building Monitoring Systems: tasks and developments, review of database

Regional Ground Motion Prediction and database

Identification of Primary input hazard parameters; Ground Motion Prediction Models (GMPM) for different study area; elaboration of ground motion data and records; Application of ground motions models and tools to the study area; re-interpretation of national code background; tool: MATLAB

**Leistungsnachweis**

1 exam (written or oral - weighting acc. to credit points)

**Exam "Primary hazards and risks / Part: Seismic Monitoring "**

**J. Schwarz**

Prüfung

Fr, Einzel, 14:00 - 17:00, Marienstraße 13 C - Hörsaal A, 17.02.2017 - 17.02.2017

**Exam "Primary hazards and risks / Part: Wind Risk Mitigation"**

**J. Schwarz**



Prüfung

Fr, Einzel, 13:30 - 15:30, Marienstraße 13 C - Hörsaal B, 24.02.2017 - 24.02.2017

## Disastermanagement and mitigation strategies

### 1764293 Postwar cities

**F. Eckardt**

Veranst. SWS: 2

Integrierte Vorlesung

Mo, Einzel, 11:00 - 12:30, Marienstraße 13 C - Hörsaal D, 10.10.2016 - 10.10.2016

Mo, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal C, 17.10.2016 - 03.02.2017

#### Kommentar

The subject of reconstructing cities after war damage has become an international research topic in the last years for two reasons. Firstly, in many countries around the world violent conflicts have destroyed large parts of cities and in some countries the process of reconstruction like in the Balkan countries is ongoing. Many of these conflicts also seemed to be endless like it appears to be now in the case of Syria and Jemen. However, if one leaves beside the extraordinary hundred year war in the European Middle Age, most wars have ended in the life time of one generation. The historical lessons also shows that after the end of a war like in Europe after the Second World War, little knowledge have been available how to reconstruct the cities. Looking back on the lessons of this and similar experiences is the second reason why the general subject of „post war cities” have become an important subject. The main goal of this seminar is to discuss both questions: 1. How can we prepare the reconstruction of cities after war and conflict in the Middle East? 2. What can be learned from historical experiences in Germany and elsewhere?

Richtet sich an: IPP, Urban Heritage, MA Urbanistik, MA European Urban Studies, MA Advanced Urbanism, MA Architektur, MA NHRE (Fak. B)

Termin: montags 11:00 bis 12:30 Uhr

Registration at the first meeting

### 2901005 Project- and Disaster Management

**H. Bargstädt**

Veranst. SWS: 3

Integrierte Vorlesung

Fr, Einzel, 14:00 - 19:00, Marienstraße 13 C - Hörsaal D, 09.12.2016 - 09.12.2016

Sa, Einzel, 09:15 - 15:00, Marienstraße 13 C - Hörsaal D, 10.12.2016 - 10.12.2016

So, Einzel, 09:15 - 15:00, Marienstraße 13 C - Hörsaal D, 11.12.2016 - 11.12.2016

Fr, Einzel, 16:00 - 17:30, Marienstraße 13 C - Hörsaal D, 13.01.2017 - 13.01.2017

Fr, wöch., 14:00 - 15:30, Marienstraße 13 C - Hörsaal A

#### Bemerkung

Modul "Disaster management and mitigation strategies" --> 6 ECTS

Part "Mitigation strategies" --> see lecture "Postwar cities"

#### Kommentar

Acquisition of knowledge of the methods of the project management and acquisition of skills with their practical application:

Imparting of means and methods as well as of social and technical aspects of the project management in the construction industry (the-oretical and on the basis practical examples)

Consolidate of knowledge in handling a project management soft-ware

Additional: Lecture of "Postwar cities"

**Leistungsnachweis**  
Klausur oder mündliche Prüfung

**Exam "Project- and Disaster Management"**

**H. Bargstädt**  
Prüfung

Mo, Einzel, 13:00 - 14:30, Marienstraße 13 C - Hörsaal A, 13.02.2017 - 13.02.2017

**Stochastics and risk assessment**

**2250009 Stochastics and Risk Assessment - Signal Analysis**

**R. Illge**  
Vorlesung

Veranst. SWS: 2

Do, wöch., 13:30 - 16:45, Marienstraße 13 C - Hörsaal B, 01.12.2016 - 02.02.2017

**Leistungsnachweis**  
Klausur oder mündliche Prüfung

**2500008 Stochastics and Risk Assessment - Mathematical simulation / Risk problems**

**T. Lahmer, K. Müller**  
Vorlesung

Veranst. SWS: 4

Mo, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal B, Prof. Lahmer, 10.10.2016 - 28.11.2016  
Di, wöch., 13:30 - 15:00, Coudraystraße 13 A - Hörsaal 2, Prof. Lahmer, 11.10.2016 - 29.11.2016  
Mo, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal B, Dr. Müller, 05.12.2016 - 31.01.2017  
Di, wöch., 13:30 - 16:45, Coudraystraße 13 A - Hörsaal 2, Dr. Müller, 06.12.2016 - 01.02.2017

**Kommentar**

Introduction to probability theory: Random events, discrete and continuous random variables; Descriptive statistics: parameters of one- and twodimensional samples, graphical representation of samples; Exploratory statistics: statistical tests and parameter estimation; Reliability theory: extreme value distributions; stochastic modeling with software tools like Matlab, Octave, Excel or R.

Characteristics and classification of random functions, which are necessary for risk analysis; catastrophic events and risk problems; hazard / risk / safety / reliability / damage / cost and fuzzy models; life time consideration; analysis by logic trees and charts (fault trees, event trees, cause/consequence charts, decision trees); risk assessment and risk acceptance.

**Leistungsnachweis**  
Klausur oder mündliche Prüfung

**Exam "Stochastics and Risk Assessment/Part:Mathematical simulation"**

**T. Lahmer**  
Prüfung

Mo, Einzel, 13:00 - 15:00, Marienstraße 13 C - Hörsaal B, 06.02.2017 - 06.02.2017

**Exam "Stochastics and Risk Assessment/Part: Signal Analysis"**

**R. Illge**

Prüfung

Mi, Einzel, 10:00 - 11:00, Marienstraße 13 C - Hörsaal B, 15.02.2017 - 15.02.2017

**Structural engineering**

**2310012 Structural engineering (Exercise)**

**G. Morgenthal**

Veranst. SWS: 2

Seminar

1-Gruppe Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 301, Group A

1-Gruppe Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Seminarraum 205, Group A

2-Gruppe Fr, Einzel, 17:00 - 18:30, Marienstraße 7 B - Projektraum 301, 25.11.2016 - 25.11.2016

2-Gruppe Fr, wöch., 15:15 - 16:45, Marienstraße 7 B - Projektraum 301, Group B

2-Gruppe Fr, wöch., 15:15 - 16:45, Marienstraße 7 B - Seminarraum 205, Group B

**2310012 Structural engineering (Lecture)**

**G. Morgenthal**

Veranst. SWS: 4

Vorlesung

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

**Exam "Structural engineering"**

**G. Morgenthal**

Prüfung

Mo, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 105, 13.02.2017 - 13.02.2017

Mo, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 106, 13.02.2017 - 13.02.2017

Mo, Einzel, 09:00 - 12:00, Marienstraße 7 B - Seminarraum 205, 13.02.2017 - 13.02.2017

Mo, Einzel, 09:00 - 12:30, Marienstraße 7 B - Seminarraum 206, 13.02.2017 - 13.02.2017

**Elective compulsory modules**

**2205010 Model Validation and Simulation - "Project Evaluation of existing structures ..."**

**L. Abrahamczyk**

Veranst. SWS: 4

Projekt

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

**2210012 Secondary Hazards and Risks (land-use, site studies)**

**K. Witt**

Veranst. SWS: 4

Integrierte Vorlesung

Di, wöch., 09:15 - 10:45, Coudraystraße 11 C - Seminarraum (geologische Sammlung) 202, Prof. Witt

**Kommentar**

Mass Movements: Classification, Landslides in Soil & Rock, Landslide hazards, Slope-Stability- Analysis, Slope Monitoring & Investigation, Slope Control, Stabilization; Problem Soils: Quick clays, Expansive and Collapsible soils

Geotechnical Earthquake Engineering: Assessment of Liquefaction potential, Amplification studies and site effects & topography, Seismic bearing capacity, Seismic design of retaining walls & Seismic earth pressure

**Voraussetzungen**

Geo- and hydrotechnical Engineering (Soil Mechanics)

**Leistungsnachweis**

1 exam (written or oral)

### 2340010 Risk projects and evaluation of structures

**J. Schwarz, L. Abrahamczyk**

Veranst. SWS: 4

Projekt

Fr, wöch., 09:15 - 12:30, Marienstraße 7 B - Projektraum 301

Fr, wöch., 09:15 - 12:30, Marienstraße 7 B - Seminarraum 205

**Kommentar**

Risk mitigation projects

German TaskForce for Earthquake and lessons from recent missions; reinterpretation of case studies for different building types; evaluation of damaged structures, basics of tagging; Rehabilitation strategies and applied reconstruction techniques; design concepts; regional seismic risk assessment projects; damage scenarios, and loss prediction; results from Global Earthquake Model (GEM)

Evaluation and Re-Design of structures

Empirical and analytical vulnerability assessment for representatives of typical building types; identification of structural, non structural and structural affecting systems; replacement and up-grading of existing systems, performance- and scenario-based evaluation of structural damage; definition of critical conditions for simplified approaches; modeling and analysis of strengthened systems.

training in calculation tools Perform3D / 3Muri

**Voraussetzungen**

B.Sc.

Primary Hazards and risks; Earthquake engineering and structural design/ GIS

**Leistungsnachweis**

1 exam (written or oral)

### 2350007 Nonlinear Analysis of Structures under Extreme Loading

**G. Morgenthal, H. Timmler, C. Taube**

Veranst. SWS: 4

Integrierte Vorlesung

Mo, wöch., 13:30 - 16:45, Marienstraße 7 B - Seminarraum 205

**Kommentar**

Geometrically and physically nonlinear analysis of steel- and RC-structures under extreme loading; energy and numerical methods;

basics of modeling of structures and loads; nonlinear material behavior; stability and large deformations of beam structures; capacity design of seismically loaded RC-structures

#### Voraussetzungen

B. Sc.

Mechanics

#### Leistungsnachweis

1 exam (written or oral)

### 2451002 Einführung in die Optimierung/Introduction to Optimization

**T. Lahmer**

Veranst. SWS: 2

Vorlesung

Mo, wöch., 09:15 - 10:45, Marienstraße 7 B - Seminarraum 106, ab 24.10.2016

#### Bemerkung

Die erhaltenen Leistungspunkte für diese Veranstaltung können auf 6 Leistungspunkte (LP) zu einem Modul ergänzt werden durch den Besuch der Vorlesung „Optimization in Applications“ im Sommersemester 2016 von Prof. Lahmer (3LP)

#### Kommentar

Beschreibung: Es werden klassische Aufgaben der linearen und nichtlinearen Optimierung besprochen, darunter der ökonomischer Einsatz von Ressourcen, Kalibrierung von Modellen, Strukturoptimierung, sowie Transport- und Routingprobleme.

Der Vorlesungscharakter ist anwendungsbezogen und richtet sich an Studierende der Ingenieurwissenschaften, Informatik sowie Betriebswirtschaft und soll Fähigkeiten vermitteln, Optimierungsmethoden zur Lösung eigens formulierter praktischer Probleme einzusetzen.

Inhalte: Benötigte mathematische Grundlagen der Analysis und linearen Algebra

Kontinuierliche Optimierung:

- Lineare Optimierung: Beispiele, Simplexverfahren, Dualität.
- Nichtlineare Optimierung: Optimierung in einer und mehrerer Variablen mit und ohne Nebenbedingungen, direkte Suchverfahren Abstiegsverfahren und genetische Programmierung

Diskrete Optimierung:

- Prinzipien des Brach and Bound, Rucksackproblem, Traveling salesman problem,
- Lineare ganzzahlige Programmierung (optional)

Auf Wunsch kann der Kurs auch in Englischer Sprache gehalten werden. On request, the course can be taught in English

**2650004 Advanced Modeling – CAE****K. Gürlebeck, D. Legatiuk**

Veranst. SWS: 4

Integrierte Vorlesung

Mo, wöch., 17:00 - 18:30, Coudraystraße 13 A - Seminarraum 115

Di, wöch., 11:00 - 12:30, Coudraystraße 13 B - Seminarraum 210

**Kommentar**

Students will have experience in Computer Aided Engineering (CAE) by establishing a problem specific model on the basis of a mathematical formulation, an applicable solution technique, design of efficient data structures and software implementation.

Konvergenz, Stabilität und Fehlerbetrachtung der Finiten-Differenz-Methode (FDM),

Modellierung stationärer und instationärer Wärmeleitprobleme

Konzepte der objekt-orientierten Programmierung: Modellbildung (UML), abstrakte Klassen und Methoden, Interfaces

Entwurf und Entwicklung eines Framework für Anwendungsentwicklung nach der Methode der Finiten Elemente (FEM)

Anwendungsentwicklung auf Basis des FEM-Framework

**Voraussetzungen**

FEM + Struct. Dyn., Adv. Mod.-Calc.

Programming in Java

**Leistungsnachweis**

1 exam (written or oral)

**907004 Fundamentals of structural health monitoring (SHM) and intelligent structural systems****K. Smarsly, K. Dragos, E. Tauscher, J. Wagner**

Integrierte Vorlesung

Mi, wöch., 09:15 - 12:30, Coudraystraße 13 D - Pool-Raum 010

**Bemerkung**

Please note: Time and location will be announced. Enrollment must be done online.

**Information on how to enroll will be provided in the first lecture on October 12, 2016 (9:15am), Coudraystr. 13D, Orion-Pool.**

**Kommentar**

Structural health monitoring (SHM) and smart structural systems, also referred to as "smart structures" or "intelligent infrastructure", are primary subjects of this course: Basic principles of modern SHM are taught; also, concepts of smart structural systems, which are capable of self-assessing their structural condition with a certain degree of intelligence, are elucidated in more detail. Measuring techniques, data acquisition systems, data management and processing as well as data analysis algorithms will be discussed. Furthermore, approaches towards autonomous

and embedded computing, to be used for continuous (remote) monitoring of civil infrastructure, are presented. Throughout the course, a number of illustrative examples is shown, demonstrating how state-of-the-art SHM systems and smart structural systems are implemented. In small groups, the students design structural health monitoring systems that are validated in the field. The outcome of every group is to be documented in a paper, which is graded, together with an oral examination, at the end of the course. Prerequisites for this course: Object-oriented modeling and Java programming language. Requirements for examination: (i) Development of a wireless SHM system, (ii) participation in the project work (including the laboratory test), (iii) written paper. No previous experience in the above fields is required by the students; limited enrollment.

#### Voraussetzungen

Object-oriented modeling and Java programming language.

#### Leistungsnachweis

Oral examination and written paper.

### Exam "Finite element methods"

#### T. Rabczuk

Prüfung

Do, Einzel, 09:00 - 11:00, Marienstraße 7 B - Seminarraum 205, 16.02.2017 - 16.02.2017

### Exam "Modelling of steel structures and numerical simulation"

#### M. Kraus

Prüfung

Mi, Einzel, 09:00 - 11:00, Marienstraße 7 B - Seminarraum 205, 22.02.2017 - 22.02.2017

### Exam "Nonlinear Analysis of Structures under Extreme Loading"

#### G. Morgenthal

Prüfung

Mo, Einzel, 09:00 - 11:00, Marienstraße 7 B - Seminarraum 205, 20.02.2017 - 20.02.2017

### Exam "Secondary hazards and risks"

#### K. Witt

Prüfung

Mi, Einzel, 09:00 - 11:00, Coudraystraße 11 C - Seminarraum (geologische Sammlung) 202, 08.02.2017 - 08.02.2017

### Numerische Modellierung und Simulation / Numerical modelling and simulation

#### C. Könke, V. Zabel

Integrierte Vorlesung

Do, wöch., 15:15 - 18:30, Marienstraße 7 B - Projektraum 301

#### Kommentar

Ausgehend von einem physikalischen Problem (z.B. Wärmeleitungsproblem oder Schwingungsproblem) wird die mathematische Formulierung (System von Differentialgleichungen) entwickelt und diese in eine numerische Näherungslösung übersetzt (z.B. Finite Differenzenverfahren). Die numerische Lösung wird in einem eigenen Softwarecode am Computer umgesetzt. Dazu werden die erworbenen Fähigkeiten in der Bauinformatik in Programmiersprachen oder Werkzeuge wie Maple/Mathematica eingesetzt.

Lehrinhalte:

Starke und schwache Formulierung des stationären und instationären Wärmeleitungsproblems. Starke und schwache Form für Schwingungsprobleme der Strukturmechanik.

Finite Differenzen Methode und Finite Element Formulierungen für Probleme der Strukturmechanik, Strukturmechanik und Wärmeleitungsprobleme;

Lösungsverfahren für lineare Gleichungssysteme; Iterationsverfahren für nichtlineare Gleichungssysteme; Zeitintegrationsverfahren in der Strukturmechanik

Fehlerschätzer für numerische Approximationsverfahren

**Voraussetzungen**

Bachelorabschluss

Sinnvoll: Finite Element Methoden