Bauhaus-Universität Weimar

Vorlesungsverzeichnis

M.Sc. Digital Engineering

Sommer 2018

Stand 16.10.2018

M.Sc. Digital Engineering

Faculty Welcome for Master's Students Digital Engineering

Tuesday, 3rd April 2018, 11.00 a.m., room 015, Bauhausstraße 11

Fundamentals (F)

Advanced Numerical Mathematics

4556105 Advanced Numerical Mathematics

K. Gürlebeck, D. Legatiuk, S. Bock Veranst. SWS: 4
Vorlesung

Mo, wöch., 11:00 - 12:30, Coudraystraße 13 B - Hörsaal 3, ab 09.04.2018
Mo, wöch., 15:15 - 16:45, Marienstraße 13 C - Hörsaal D, ab 09.04.2018
Mo, Einzel, 15:15 - 16:45, Coudraystraße 13 A - Hörsaal 2, 25.06.2018 - 25.06.2018
Do, Einzel, 09:00 - 11:00, Coudraystraße 13 B - Hörsaal 3, exam, 26.07.2018 - 26.07.2018

Beschreibung

Höhere Numerik

Effiziente Lösung linearer und nichtlinearer Gleichungssysteme;
• Diskretisierungsmethoden für verschiedene Typen partieller Differentialgleichungen
• Projektionsverfahren, Stabilität, Konvergenz und Konditionszahl
• Direkte Löser für schwach besetzte Systemmatrizen
• Fixpunktsatz, iterative Löser, Gesamtschrittverfahren, Einzelschrittverfahren, Gradientenverfahren, Relaxationsverfahren, Multiskalenmethoden und Überblick über andere Zugänge
• Eigenwertprobleme, iterative Löser
• Gebietszerlegungsverfahren

engl. Beschreibung

Advanced Numerical Mathematics

Efficient solution of linear and non-linear systems of algebraic equations;
• Discretization methods for different types of partial differential equations
• Projection methods, stability and convergence, condition number
• Direct solvers for sparse systems
• Fixed-point theorem, iterative solvers: Total step method, single step method, gradient methods, relaxation methods, multiscale methods and a survey on other approaches
• Eigenvalue problems, iterative solvers
• Domain decomposition methods

Voraussetzungen

Courses in Linear Algebra, Analysis

Leistungsnachweis

Project

Algorithms and Datastructures

4555211 Algorithmen und Datenstrukturen

C. Wüthrich, G. Pandolfo Veranst. SWS: 4

Vorlesung

Do, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B, Vorlesung, ab 12.04.2018
Mi, wöch., 09:15 - 10:45, Coudraystraße 13 A - Hörsaal 2, Übung, ab 18.04.2018
Mo, Einzel, 10:00 - 12:00, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Klausur, 23.07.2018 - 23.07.2018

Beschreibung

Das Lernziel dieser Veranstaltung soll zum einen der generelle Umgang und die selbstständige Entwicklung, Analyse, und Optimierung von Algorithmen und Datenstrukturen sein. Zum anderen soll ein Überblick über gängige problemspezifische Verfahren und deren Anwendung in der Praxis vermittelt werden.

engl. Beschreibung

Algorithms and Data Structures

The lecture deals with the principle and the implementation of basic algorithms and data structures. The course teaches among all, the Strings, geometric problems, graphs, mathematical algorithms and NP-complete problems.

Leistungsnachweis

Beleg, Klausur

Applied Mathematics and Stochastics

Nonlinear Continuum Mechanics

Software Engineering

Statistics

301005 Statistics

R. Illge Veranst. SWS: 4

Integrierte Vorlesung

Do, wöch., 07:30 - 09:00, Coudraystraße 13 B - Hörsaal 3, Lecture / Lab class, ab 05.04.2018
Di, wöch., 13:30 - 15:00, Coudraystraße 13 B - Hörsaal 3, Lecture / Lab class, ab 10.04.2018
Di, Einzel, 09:00 - 12:00, Coudraystraße 13 A - Hörsaal 2, exam, 24.07.2018 - 24.07.2018

engl. Beschreibung

Statistics

Contents:

Probability (Events, classical probability, axiomatic approach, conditional probability) Random variables (Discrete random variables, continuous random variables, limit theorems) Descriptive statistics (Graphical representation and frequency distributions, location and scattering parameters, bivariate and multivariate analysis: dependence and correlation, regression analysis) Inductive statistics

- Point and interval estimation
- Parameter testing
- Goodness-of-fit-tests
- Nonparametric tests
- Tests for independence and correlation

Voraussetzungen

B.Sc. in a related study field, Basic knowledge on random variables and the most important distributions

Leistungsnachweis

Written exam

Structural Dynamics

Structural Engineering Models

401007 Structural Engineering Models

C. Könke Veranst. SWS: 4

Integrierte Vorlesung

Di, wöch., 15:15 - 16:45, Marienstraße 13 C - Hörsaal A, ab 24.04.2018
Do, unger. Wo, 15:15 - 16:45, Marienstraße 13 C - Hörsaal B, ab 26.04.2018
Fr, Einzel, 13:00 - 15:00, Marienstraße 13 C - Hörsaal A, Final examination, 27.07.2018 - 27.07.2018
Di, wöch., 15:15 - 16:45, Marienstraße 7 B - Seminarraum 205
Do, wöch., 15:15 - 16:45, Marienstraße 7 B - Seminarraum 105

Beschreibung

Student will be able to build an abstract model for structural engineering problem and to assess its restriction and quality. The student will be able to perform dimen-sion reduction in structural engineering using concepts from structural mechanics. They will be capable of classify different types of civil engineering structures and to distinguish different principal load transfer processes. The student can classify line-ar/nonlinear problems and time variant/ invariant problems in structural engineering.

Fundamental equations in structural mechanics for 1D, 2D and 3D structures, equi-librium equation, kinematic relation, constitute law, Method to establish the govern-ing differential equations, Differences between geometric / physical linear and non-linear problems, Classification of different types of structures: truss, beam, plate, shell problems

Voraussetzungen

basic course in structural mechanics

basic course in applied mathematics

Leistungsnachweis

written test

Requirements for exam registration: 2 home works accepted

Modelling (M)

4- und 5D-Building Information Modeling (BIM)

Advanced Building Information Modeling

303001 Advanced Building Information Modelling

C. Koch, E. Tauscher, K. Smarsly, T. Behnke, J. Wagner Veranst. SWS: 4
Vorlesung

Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 301, lab, ab 05.04.2018
Mi, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B, lecture, ab 11.04.2018
Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 302, lab, ab 12.04.2018
Fr, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301, lab, ab 20.04.2018
Fr, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 302, lab, ab 20.04.2018
Mi, Einzel, 11:00 - 12:30, Coudraystraße 13 A - Hörsaal 2, lecture, 16.05.2018 - 16.05.2018
Mo, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal A, 16.07.2018 - 16.07.2018

engl. Beschreibung

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.

Voraussetzungen

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

Leistungsnachweis

written report, presentation

Advanced Modelling - Calculation

301013 Advanced Modelling – Calculation/CAE

K. Gürlebeck, D. Legatiuk Veranst. SWS: 4
Vorlesung

Mi, Einzel, 09:00 - 11:00, Coudraystraße 13 B - Seminarraum 210, Final Examination, 25.07.2018 - 25.07.2018
Di, wöch., 09:15 - 12:30, Coudraystraße 13 B - Seminarraum 210

Beschreibung

Scientifically orientated education in mathematical modelling and computer science in view of a complex interdisciplinary and networked field of work and research, modelling and simulation. 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.

Numerical and analytical solution of partial differential equations, series expansions, integral representations, finite difference methods, description of heat flow, diffusion, wave propagation and elastostatic problems. The topics are discussed theoretically and then implemented. Convergence, stability and error analysis of finite difference methods (FDM). Modelling of steady and unsteady heat conduction problems, wave propagation and vibrations and problems from linear thermo-elasticity in 2D and 3D. After considering the mathematical basis, the students will work on individual projects passing all levels of work (engineering model, mathematical model, numerical model, computer model, simulation, evaluation). The solution methods will be implemented by help of MAPLE or MATLAB.

Bemerkung

This lecture replaces "Advanced Analysis". It is therefore not possible to receive credits for both courses.

Die Veranstaltung ersetzt "Advanced Analysis" und kann daher nicht gemeinsam mit dieser Veranstaltung angerechnet werden.

Leistungsnachweis

1 exam (written or oral)

Collaborative Data Management

Computer models for physical processes – from observation to simulation

Introduction to Optimization

451002+45 Introduction to Optimization / Optimization in Applications

T. Lahmer Veranst. SWS: 4

Vorlesung

Fr, Einzel, 13:00 - 15:00, Marienstraße 13 C - Hörsaal A, Final Examination, 20.07.2018 - 20.07.2018
Mo, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal B
Mi, wöch., 17:00 - 18:30, Marienstraße 13 C - Hörsaal C

Beschreibung

Introduction to Optimization (451002 - 3ECTS):

Definitions, Classification of Optimization Problems, Linear Problems, Simplex Method, Duality, Optimization on Graphs Nonlinear Problems: Constrained and unconstrained continuous problems, descent methods and variants

Optimization in Applications (451006 - 3 ECTS):

This course treats topics concerned with the combination of optimization methods and (numerical) models. Typical problems, where such combinations arise, are Calibration of Models, Inverse Problems; (Robust) Structural Optimization (including Shape and Topologyoptimization); Design of Experiments

Bemerkung

The course can be regarded as a continuation of „Introduction to Optimization“, however a visit of that course is not mandatory.

Leistungsnachweis

1 written or oral exam (depending on the number of participants)
„Introduction to Optimization”/ (50%)

1 written or oral exam (depending on the number of participants)
„Optimization in Applications”/ (50%)

Modelling in the development process

Optimization in Applications

451002+45 Introduction to Optimization / Optimization in Applications

T. Lahmer Veranst. SWS: 4

Vorlesung
Fr, Einzel, 13:00 - 15:00, Marienstraße 13 C - Hörsaal A, Final Examination, 20.07.2018 - 20.07.2018
Mo, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal B
Mi, wöch., 17:00 - 18:30, Marienstraße 13 C - Hörsaal C

Beschreibung

Introduction to Optimization (451002 - 3ECTS):

Definitions, Classification of Optimization Problems, Linear Problems, Simplex Method, Duality, Optimization on Graphs Nonlinear Problems: Constrained and unconstrained continuous problems, descent methods and variants

Optimization in Applications (451006 - 3 ECTS):

This course treats topics concerned with the combination of optimization methods and (numerical) models. Typical problems, where such combinations arise, are Calibration of Models, Inverse Problems; (Robust) Structural Optimization (including Shape and Topologyoptimization); Design of Experiments

Bemerkung

The course can be regarded as a continuation of „Introduction to Optimization“, however a visit of that course is not mandatory.

Leistungsnachweis

1 written or oral exam (depending on the number of participants)
„Introduction to Optimization”/ (50%)

1 written or oral exam (depending on the number of participants)
„Optimization in Applications”/ (50%)

Simulation and Validation (SaV)

Design and Interpretation of Experiments / Signal Processing

Experimental Structural Dynamics

401009 Experimental structural dynamics and Structural monitoring (P)

V. Zabel Veranst. SWS: 4
Projekt
Di, wöch., 07:30 - 12:30, Marienstraße 7 B - Projektraum 301

Beschreibung

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

Bemerkung

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.

14 students NHRE only

Voraussetzungen

Structural dynamics

Leistungsnachweis

Project report, presentation

Excursion from 11.05 to 15.05.2015 to University of Thessaloniki

Extended Finite Elements and Mesh Free Methods

Fundamentals of structural health monitoring (SHM) and intelligent structural systems

Linear FEM

Modelling of Steel Structures and Numerical Simulation

205007 Modelling of steel structures and numerical simulation

M. Kraus, S. Mämpel, B. Wittor Veranst. SWS: 4

Vorlesung

Do, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal D, Final Examination, 19.07.2018 - 19.07.2018
Mo, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal D
Mo, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 301
Mi, wöch., 07:30 - 09:00, Marienstraße 13 C - Hörsaal C, Examination
Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301

engl. Beschreibung

Design of steel structures using finite element methods; basics of the design; modelling of structures and loads; nonlinear material behaviour, numerical analyses of steel-members and structures regarding geometric and physical nonlinearities; stability behaviour of members including flexural and lateral torsional buckling

Leistungsnachweis

1 Project report ”Modelling of steel structures and numerical simulation” (0%) / SuSe

1 written exam „Modelling of steel structures and numerical simulation”/ 120 min (100%) / SuSe + WiSe

Nonlinear FEM

Process modelling and simulation in logistics and construction

Simulation Methods in Engineering

303002 Simulation Methods in Engineering

C. Koch, M. Artus Veranst. SWS: 4

Vorlesung

Fr, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal D, lecture, ab 06.04.2018
Fr, wöch., 13:30 - 15:00, lab 303, M7b (5mal), ab 06.04.2018
Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 301, lab (7mal), ab 06.04.2018
Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 302, lab (7 mal), ab 13.04.2018
Mo, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301, lab, ab 16.04.2018
Mo, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 302, lab, ab 16.04.2018

engl. Beschreibung

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 simula-tion 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 require-ments for participation: Basic knowledge of programming

Leistungsnachweis

Short group report, group presentation, written exam

Stochastic Simulation Techniques and Structural Reliability

Visualization and Data Science (VaDS)

Image Analysis and Object Recognition

4336010 Image analysis and object recognition

V. Rodehorst, J. Kersten Veranst. SWS: 3

Vorlesung

Di, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal C, Lecture, ab 03.04.2018
Do, unger. Wo, 11:00 - 12:30, Marienstraße 13 C - Hörsaal C, Lab, ab 12.04.2018
Di, Einzel, 11:00 - 13:00, Marienstraße 13 C - Hörsaal B, exam, 17.07.2018 - 17.07.2018

Beschreibung

Bildanalyse und Objekterkennung

Die Vorlesung gibt eine Einführung in die Grundlagen der Mustererkennung und Bildanalyse. Behandelt werden unter anderem die Bildverbesserung, lokale und morphologische Operatoren, Kantenerkennung, Bilddarstellung im Frequenzraum, Fourier-Transformation, Hough-Transformation, Segmentierung, Skelettierung, Objektklassifizierung und maschinelles Lernen zur visuellen Objekterkennung.

engl. Beschreibung

Image analysis and object recognition

The lecture gives an introduction to the basic concepts of pattern recognition and image analysis. It covers topics as image enhancement, local and morphological operators, edge detection, image representation in frequency domain, Fourier transform, Hough transform, segmentation, thinning, object categorization and machine learning for visual object recognition.

Bemerkung

Digital Engineering: 4 SWS

Leistungsnachweis

Erfolgreiche Bearbeitung der Übungen (sowie des Projekts) und Klausur

Introduction to Machine Learning

Photogrammetric Computer Vision

Search Algorithms

Search-Based Software Engineering

417290001 Search-Based Software Engineering

N. Siegmund Veranst. SWS: 3

Vorlesung

Mo, wöch., 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 015, Lecture, ab 09.04.2018
Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Lab class, ab 10.04.2018

engl. Beschreibung

Search-Based Software Engineering

Search-Based Software Engineering is about learning and optimizing complex tasks that are computationally intractable for exact methods. The goal of this course is to understand the principles of meta-heuristics in optimization as well as on handling constraints and dimensionality.

Students should understand the following techniques and theories:

- Problem space exploration and search-based optimization
- Meta-heuristics for single and multiple objective optimization
- Relationship between biological learning and optimization with algorithms
- Dimensionality-reduction techniques
- Constraint resolution

Students should be able to apply the above theories for solving concrete learning and optimization problems. Furthermore, they should appreciate the limits and constraints of the individual methods above.

Students should be able formalize and generalize their own solutions using the above concepts and implement them in a specified language (preferable in Python).

Students should master concepts and approaches such as

- Simulated annealing
- Swarm optimization
- Ant colonization
- Evolutionary algorithms
- Dimensionality Reduction (PCA + Feature Subset Selection)
- Constraint Satisfaction Problem Solving

in order to tackle problems learning and optimizing huge problems, which are inherent to Digital Media. They should also be able to implement the algorithms and techniques in Python and be able to understand a proposed problem, to compare different approaches and techniques regarding applicability and accuracy, to make well-informed decisions about the preferred solution and, if necessary, to find their own solutions.

Students should develop an understanding of the current state of research in optimization and learning. With appropriate supervision, students should be able to tackle new research problems, especially in the area of search-based software engineering.

Bemerkung

Ehemals "Machine Learning for Software Engineering". Dieser Kurs kann daher nur belegt werden, wenn der Kurs "Machine Learning for Software Engineering (417130002)" noch nicht erfolgreich abgeschlossen wurde.

Formely known as "Machine Learning for Software Engineering". Therefore the class can only be taken, if the class "Machine Learning for Software Engineering **(417130002)**" has not yet been sucessfully completed.

Voraussetzungen

BSc in a relevant study field

Leistungsnachweis

Written or oral examination. Participation requires the successful completion of the course labs (tasks over the semester). Digital Engineering students will be required to successfully complete an additional project.

Software Product Line Engineering

418120019 Software Product Line Engineering

N. Siegmund Veranst. SWS: 3

Vorlesung

Mi, wöch., 09:15 - 10:45, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lecture, ab 04.04.2018
Fr, wöch., 11:00 - 12:30, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lab class, ab 06.04.2018

Beschreibung

Softwareproduktlinien und konfigurierbare Softwaresysteme bilden eine Schlüsseltechnologie für die Massenproduktion individuell angepasster Software. Ziel ist es bei der Entwicklung maßgeschneiderter Software, die Codebasis weiterhin wartbar zu halten sowie gleichzeitig die Produktionskosten zu reduzieren. Die Veranstaltung vermittelt die wichtigsten Kenntnisse und Fähigkeiten, um dieses Ziel zu erreichen:

- Die Studierenden kennen die Vorteile und Nachteile des Produktlinienansatzes sowie klassischer und moderner Programmiermethoden wie z.B. Präprozessoren, Versionsverwaltungssysteme, Komponenten, Frameworks, Feature-Orientierung, Aspekt-Orientierung.
- Die Studierenden haben die Befähigung zur Bewertung, Auswahl und Anwendung moderner Programmierparadigmen, Techniken, Methoden und Werkzeuge erlangt, insbesondere in Hinblick auf die Entwicklung von Kompetenzen im Bereich der Softwareproduktlinien.
- Die Studierenden erwerben Urteilsvermögen über den Einsatz von Programmiermethoden für die Entwicklung von Softwareproduktlinien.

Folgender Inhalt wird bei der Lehrveranstaltung vermittelt:

- Einführung in die Problematik der Entwicklung komplexer, maßgeschneiderter Softwaresysteme am Beispiel von eingebetteten Datenbankmanagementsystemen
- Modellierung und Implementierung von Programmfamilien, Produktlinien und domänenspezifischen Generatoren
- Wiederholung von Grundkonzepten der Software-Technik (Kohäsion, Scattering und Tangling, Information Hiding, Modularisierung)
- Einführung in verschiedene klassische und moderne Sprachen und Werkzeuge zur Entwicklung von Softwareproduktlinien u.a. Präprozessoren, Frameworks, Komponenten, Feature-Module, Aspekte, Kollaborationen, Rollen, etc.
- Vergleich grundlegender Konzepte, Methoden, Techniken und Werkzeuge der vorgestellten Ansätze
- Kritische Diskussion von Vor- und Nachteilen der einzelnen Ansätze sowie ihrer Beziehung untereinander
- Weiterführende Themen: Nicht-funktionale Eigenschaften, Analyse von Produktlinien, Featureinteraktionen,

Aktuelle Forschungsergebnisse des Lehrstuhls werden in der Veranstaltung besprochen, angewendet und diskutiert

engl. Beschreibung

Software Product Line Engineering

Software product lines and configurable software systems are the main driving factor for mass customization, tailor-made products, and product diversity while keeping a maintainable code base and saving development time. The lecture will teach about central elements of product line modelling and development.

Students should understand the following techniques and theories:

- Configuration management and variability modeling
- Classic and modern programming techniques, such as preprocessors, version control systems, components, frameworks, aspect-oriented programming, and feature-oriented programming
- Feature interactions and virtual separation of concerns

Students should be able to apply the above theories and concepts to judge points in favour and against a certain technique depending on the application scenario at hand. Hence, the students will be able to decide which techniques, tools, and methods to use.

Students should master concepts and approaches such as

- The exponential complexity of variability spaces
- Modelling and implementation of program families, product lines, and domain specific generators
- Basic concepts of software engineering (e.g., cohesion, scattering, tangling, information hiding)
- Classic and modern concepts, such as preprocessors, plug-in systems, feature modules, collaborations, aspects, and roles
- Critical discussion about pros and cons of the above techniques and concepts
- Feature interactions, non-functional properties, product line analysis

Students will implement these concepts in Java.

Students should develop an understanding of the current state of research in software product lines. With appropriate supervision, students should be able to tackle new research problems, especially in the area of product line development and optimization.

Voraussetzungen

BSc in a relevant study field

Leistungsnachweis

Written or oral examination. Participation requires the successful completion of the course labs. Digital Engineering students will be required to successfully complete an additional project / course lab

Visualization

4555262 Visualisierung (Visualization)

B. Fröhlich, P. Riehmann, C. Matthes Veranst. SWS: 3

Vorlesung

Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Pool-Raum 128, Übung (Bachelor), ab 24.04.2018
Di, wöch., 18:30 - 20:00, Bauhausstraße 11 - Pool-Raum 128, Übung /Lab class (Master), ab 24.04.2018
Do, wöch., 13:30 - 15:00, Bauhausstraße 11 - Seminarraum 015, Vorlesung/Lecture, ab 26.04.2018
Mi, Einzel, 10:00 - 14:00, Bauhausstraße 9a - Meeting-/Präsentationsbereich 301/302, Präsentation der Abschlussprojekte, 12.09.2018 - 12.09.2018

Beschreibung

Im ersten Teil der Veranstaltung werden die wichtigsten Verfahren und Techniken aus dem Bereich der Informationsvisualisierung für folgende Datentypen vorgestellt: multi-dimensionale und hierarchische Daten, Graphen, Zeitreihen, kartographische und kategorische Daten. Der zweite Teil beschäftigt sich mit verschiedenen Ansätzen und Algorithmen zur Visualisierung volumetrischer und vektorieller Simulations- und Messdaten. Die Veranstaltung wird englischsprachig angeboten.

engl. Beschreibung

Visualization

The first part of this course presents fundamental and advanced information visualization techniques for multi-dimensional and hierarchical data, graphs, time-series data, cartographic and categorical data. During the second half, algorithms and models for the scientific visualization of volumetric and vector-based data as well as corresponding out-of-core and level-of-detail techniques for handling very large datasets are introduced.

Various approaches presented in lectures will be studied, in part practically through labs and assignments, and with case studies. Lab classes focus on implementing, testing and evaluating the visualization approaches presented during the lectures. This course will be taught in English.

Bemerkung

Die Veranstaltung wird englischsprachig angeboten.

Voraussetzungen

Fundamental programming skills are required. Java and basic GLSL programming will be used in the lab classes. Basic computer graphics knowledge is helpful, e.g. the computer graphics course of the Medieninformatik Bachelor programme.

Leistungsnachweis

Vorlesungsbegleitende Übungen, Abschlussprojekt, mündliche Prüfung

Elective Modules

205007 Modelling of steel structures and numerical simulation

M. Kraus, S. Mämpel, B. Wittor Veranst. SWS: 4

Vorlesung

Do, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal D, Final Examination, 19.07.2018 - 19.07.2018
Mo, wöch., 13:30 - 15:00, Marienstraße 13 C - Hörsaal D
Mo, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 301
Mi, wöch., 07:30 - 09:00, Marienstraße 13 C - Hörsaal C, Examination
Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301

engl. Beschreibung

Design of steel structures using finite element methods; basics of the design; modelling of structures and loads; nonlinear material behaviour, numerical analyses of steel-members and structures regarding geometric and physical nonlinearities; stability behaviour of members including flexural and lateral torsional buckling

Leistungsnachweis

1 Project report ”Modelling of steel structures and numerical simulation” (0%) / SuSe

1 written exam „Modelling of steel structures and numerical simulation”/ 120 min (100%) / SuSe + WiSe

301005 Statistics

R. Illge Veranst. SWS: 4

Integrierte Vorlesung

Do, wöch., 07:30 - 09:00, Coudraystraße 13 B - Hörsaal 3, Lecture / Lab class, ab 05.04.2018
Di, wöch., 13:30 - 15:00, Coudraystraße 13 B - Hörsaal 3, Lecture / Lab class, ab 10.04.2018
Di, Einzel, 09:00 - 12:00, Coudraystraße 13 A - Hörsaal 2, exam, 24.07.2018 - 24.07.2018

engl. Beschreibung

Statistics

Contents:

Probability (Events, classical probability, axiomatic approach, conditional probability) Random variables (Discrete random variables, continuous random variables, limit theorems) Descriptive statistics (Graphical representation and frequency distributions, location and scattering parameters, bivariate and multivariate analysis: dependence and correlation, regression analysis) Inductive statistics

- Point and interval estimation
- Parameter testing
- Goodness-of-fit-tests
- Nonparametric tests
- Tests for independence and correlation

Voraussetzungen

B.Sc. in a related study field, Basic knowledge on random variables and the most important distributions

Leistungsnachweis

Written exam

301013 Advanced Modelling – Calculation/CAE

K. Gürlebeck, D. Legatiuk Veranst. SWS: 4

Vorlesung

Mi, Einzel, 09:00 - 11:00, Coudraystraße 13 B - Seminarraum 210, Final Examination, 25.07.2018 - 25.07.2018
Di, wöch., 09:15 - 12:30, Coudraystraße 13 B - Seminarraum 210

Beschreibung

Scientifically orientated education in mathematical modelling and computer science in view of a complex interdisciplinary and networked field of work and research, modelling and simulation. 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.

Numerical and analytical solution of partial differential equations, series expansions, integral representations, finite difference methods, description of heat flow, diffusion, wave propagation and elastostatic problems. The topics are discussed theoretically and then implemented. Convergence, stability and error analysis of finite difference methods (FDM). Modelling of steady and unsteady heat conduction problems, wave propagation and vibrations and problems from linear thermo-elasticity in 2D and 3D. After considering the mathematical basis, the students will work on individual projects passing all levels of work (engineering model, mathematical model, numerical model, computer model, simulation, evaluation). The solution methods will be implemented by help of MAPLE or MATLAB.

Bemerkung

This lecture replaces "Advanced Analysis". It is therefore not possible to receive credits for both courses.

Die Veranstaltung ersetzt "Advanced Analysis" und kann daher nicht gemeinsam mit dieser Veranstaltung angerechnet werden.

Leistungsnachweis

1 exam (written or oral)

303001 Advanced Building Information Modelling

C. Koch, E. Tauscher, K. Smarsly, T. Behnke, J. Wagner Veranst. SWS: 4

Vorlesung

Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 301, lab, ab 05.04.2018
Mi, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B, lecture, ab 11.04.2018
Do, wöch., 09:15 - 10:45, Marienstraße 7 B - Projektraum 302, lab, ab 12.04.2018
Fr, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301, lab, ab 20.04.2018
Fr, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 302, lab, ab 20.04.2018
Mi, Einzel, 11:00 - 12:30, Coudraystraße 13 A - Hörsaal 2, lecture, 16.05.2018 - 16.05.2018
Mo, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal A, 16.07.2018 - 16.07.2018

engl. Beschreibung

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.

Voraussetzungen

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

Leistungsnachweis

written report, presentation

303002 Simulation Methods in Engineering

C. Koch, M. Artus Veranst. SWS: 4

Vorlesung

Fr, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal D, lecture, ab 06.04.2018
Fr, wöch., 13:30 - 15:00, lab 303, M7b (5mal), ab 06.04.2018
Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 301, lab (7mal), ab 06.04.2018
Fr, wöch., 13:30 - 15:00, Marienstraße 7 B - Projektraum 302, lab (7 mal), ab 13.04.2018
Mo, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301, lab, ab 16.04.2018
Mo, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 302, lab, ab 16.04.2018

engl. Beschreibung

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 simula-tion 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 require-ments for participation: Basic knowledge of programming

Leistungsnachweis

Short group report, group presentation, written exam

401007 Structural Engineering Models

C. Könke Veranst. SWS: 4

Integrierte Vorlesung

Di, wöch., 15:15 - 16:45, Marienstraße 13 C - Hörsaal A, ab 24.04.2018
Do, unger. Wo, 15:15 - 16:45, Marienstraße 13 C - Hörsaal B, ab 26.04.2018
Fr, Einzel, 13:00 - 15:00, Marienstraße 13 C - Hörsaal A, Final examination, 27.07.2018 - 27.07.2018
Di, wöch., 15:15 - 16:45, Marienstraße 7 B - Seminarraum 205
Do, wöch., 15:15 - 16:45, Marienstraße 7 B - Seminarraum 105

Beschreibung

Student will be able to build an abstract model for structural engineering problem and to assess its restriction and quality. The student will be able to perform dimen-sion reduction in structural engineering using concepts from structural mechanics. They will be capable of classify different types of civil engineering structures and to distinguish different principal load transfer processes. The student can classify line-ar/nonlinear problems and time variant/ invariant problems in structural engineering.

Fundamental equations in structural mechanics for 1D, 2D and 3D structures, equi-librium equation, kinematic relation, constitute law, Method to establish the govern-ing differential equations, Differences between geometric / physical linear and non-linear problems, Classification of different types of structures: truss, beam, plate, shell problems

Voraussetzungen

basic course in structural mechanics

basic course in applied mathematics

Leistungsnachweis

written test

Requirements for exam registration: 2 home works accepted

401009 Experimental structural dynamics and Structural monitoring (P)

V. Zabel Veranst. SWS: 4

Projekt

Di, wöch., 07:30 - 12:30, Marienstraße 7 B - Projektraum 301

Beschreibung

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

Bemerkung

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.

14 students NHRE only

Voraussetzungen

Structural dynamics

Leistungsnachweis

Project report, presentation

Excursion from 11.05 to 15.05.2015 to University of Thessaloniki

417290001 Search-Based Software Engineering

N. Siegmund Veranst. SWS: 3

Vorlesung

Mo, wöch., 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 015, Lecture, ab 09.04.2018
Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Lab class, ab 10.04.2018

engl. Beschreibung

Search-Based Software Engineering

Search-Based Software Engineering is about learning and optimizing complex tasks that are computationally intractable for exact methods. The goal of this course is to understand the principles of meta-heuristics in optimization as well as on handling constraints and dimensionality.

Students should understand the following techniques and theories:

- Problem space exploration and search-based optimization
- Meta-heuristics for single and multiple objective optimization
- Relationship between biological learning and optimization with algorithms
- Dimensionality-reduction techniques
- Constraint resolution

Students should be able to apply the above theories for solving concrete learning and optimization problems. Furthermore, they should appreciate the limits and constraints of the individual methods above.

Students should be able formalize and generalize their own solutions using the above concepts and implement them in a specified language (preferable in Python).

Students should master concepts and approaches such as

- Simulated annealing
- Swarm optimization
- Ant colonization
- Evolutionary algorithms
- Dimensionality Reduction (PCA + Feature Subset Selection)
- Constraint Satisfaction Problem Solving

in order to tackle problems learning and optimizing huge problems, which are inherent to Digital Media. They should also be able to implement the algorithms and techniques in Python and be able to understand a proposed problem, to compare different approaches and techniques regarding applicability and accuracy, to make well-informed decisions about the preferred solution and, if necessary, to find their own solutions.

Students should develop an understanding of the current state of research in optimization and learning. With appropriate supervision, students should be able to tackle new research problems, especially in the area of search-based software engineering.

Bemerkung

Ehemals "Machine Learning for Software Engineering". Dieser Kurs kann daher nur belegt werden, wenn der Kurs "Machine Learning for Software Engineering (417130002)" noch nicht erfolgreich abgeschlossen wurde.

Formely known as "Machine Learning for Software Engineering". Therefore the class can only be taken, if the class "Machine Learning for Software Engineering **(417130002)**" has not yet been sucessfully completed.

Voraussetzungen

BSc in a relevant study field

Leistungsnachweis

Written or oral examination. Participation requires the successful completion of the course labs (tasks over the semester). Digital Engineering students will be required to successfully complete an additional project.

4336010 Image analysis and object recognition

V. Rodehorst, J. Kersten Veranst. SWS: 3

Vorlesung

Di, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal C, Lecture, ab 03.04.2018
Do, unger. Wo, 11:00 - 12:30, Marienstraße 13 C - Hörsaal C, Lab, ab 12.04.2018
Di, Einzel, 11:00 - 13:00, Marienstraße 13 C - Hörsaal B, exam, 17.07.2018 - 17.07.2018

Beschreibung

Bildanalyse und Objekterkennung

Die Vorlesung gibt eine Einführung in die Grundlagen der Mustererkennung und Bildanalyse. Behandelt werden unter anderem die Bildverbesserung, lokale und morphologische Operatoren, Kantenerkennung, Bilddarstellung im Frequenzraum, Fourier-Transformation, Hough-Transformation, Segmentierung, Skelettierung, Objektklassifizierung und maschinelles Lernen zur visuellen Objekterkennung.

engl. Beschreibung

Image analysis and object recognition

The lecture gives an introduction to the basic concepts of pattern recognition and image analysis. It covers topics as image enhancement, local and morphological operators, edge detection, image representation in frequency domain, Fourier transform, Hough transform, segmentation, thinning, object categorization and machine learning for visual object recognition.

Bemerkung

Digital Engineering: 4 SWS

Leistungsnachweis

Erfolgreiche Bearbeitung der Übungen (sowie des Projekts) und Klausur

451002+45 Introduction to Optimization / Optimization in Applications

T. Lahmer Veranst. SWS: 4

Vorlesung

Fr, Einzel, 13:00 - 15:00, Marienstraße 13 C - Hörsaal A, Final Examination, 20.07.2018 - 20.07.2018
Mo, wöch., 09:15 - 10:45, Marienstraße 13 C - Hörsaal B
Mi, wöch., 17:00 - 18:30, Marienstraße 13 C - Hörsaal C

Beschreibung

Introduction to Optimization (451002 - 3ECTS):

Definitions, Classification of Optimization Problems, Linear Problems, Simplex Method, Duality, Optimization on Graphs Nonlinear Problems: Constrained and unconstrained continuous problems, descent methods and variants

Optimization in Applications (451006 - 3 ECTS):

This course treats topics concerned with the combination of optimization methods and (numerical) models. Typical problems, where such combinations arise, are Calibration of Models, Inverse Problems; (Robust) Structural Optimization (including Shape and Topologyoptimization); Design of Experiments

Bemerkung

The course can be regarded as a continuation of „Introduction to Optimization“, however a visit of that course is not mandatory.

Leistungsnachweis

1 written or oral exam (depending on the number of participants)
„Introduction to Optimization”/ (50%)

1 written or oral exam (depending on the number of participants)
„Optimization in Applications”/ (50%)

4526501 Academic English Part One

H. Atkinson Veranst. SWS: 2

Kurs

Do, Einzel, 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, Einstufungstest / Placementtest for first participants, 05.04.2018 - 05.04.2018
Di, wöch., 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, 17.04.2018 - 03.07.2018
Di, Einzel, 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, exam, 10.07.2018 - 10.07.2018

engl. Beschreibung

Academic English Part One

This is the first part of a two-part course which aims to improve your ability to express yourself clearly in written English and to develop a suitably coherent academic writing style. Part One concentrates mainly on structure in writing academic articles, essays and reports. We begin by examining the structure of individual paragraphs and move on to extended texts of various types (e.g. process essays, cause/effect, comparison/contrast, etc.). Particular attention is paid to connectives, i.e. transitional phrases and constructions which help you link ideas and paragraphs in a logical, systematic way.

Voraussetzungen

In order to qualify for the course, it is necessary to take a placement test. You are advised to take Part One first, although it is possible to take both parts concurrently (i.e. in the same semester) or in reverse order.
PLACEMENT TEST: October 24th, 2017, 5 p.m, room 015, Bauhausstr. 11

Leistungsnachweis

written examination

4526502 Academic English Part Two

H. Atkinson Veranst. SWS: 2
Kurs
Do, Einzel, 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, Einstufungstest/Placementtest for first time participants, 05.04.2018 - 05.04.2018
Mi, wöch., 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, Lecture, 18.04.2018 - 04.07.2018
Mi, Einzel, 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 015, exam, 11.07.2018 - 11.07.2018

engl. Beschreibung

Academin English Part Two

Part Two of the Academic English course concentrates on improving and refining aspects of academic style. It includes sections on clause and sentence structure, punctuation rules and how to incorporate quotations, statistics and footnotes into academic texts. Students will be encouraged to bring along examples of their own written work, which the class can then correct and improve together in a constructive, mutually supportive atmosphere.

Voraussetzungen

In order to qualify for the course, it is necessary to have passed Part One. You are advised to take Part One first, although it is possible to take both parts concurrently (i.e. in the same semester) or in reverse order.
If you wish to take Part Two first, it is necessary to take a placement test.
PLACEMENT TEST: October 24th, 2017, 5 p.m, room 015, Bauhausstr. 11

Leistungsnachweis

written examination

4555211 Algorithmen und Datenstrukturen

C. Wüthrich, G. Pandolfo Veranst. SWS: 4
Vorlesung
Do, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B, Vorlesung, ab 12.04.2018
Mi, wöch., 09:15 - 10:45, Coudraystraße 13 A - Hörsaal 2, Übung, ab 18.04.2018
Mo, Einzel, 10:00 - 12:00, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Klausur, 23.07.2018 - 23.07.2018

Beschreibung

Das Lernziel dieser Veranstaltung soll zum einen der generelle Umgang und die selbstständige Entwicklung, Analyse, und Optimierung von Algorithmen und Datenstrukturen sein. Zum anderen soll ein Überblick über gängige problemspezifische Verfahren und deren Anwendung in der Praxis vermittelt werden.

engl. Beschreibung

Algorithms and Data Structures

The lecture deals with the principle and the implementation of basic algorithms and data structures. The course teaches among all, the Strings, geometric problems, graphs, mathematical algorithms and NP-complete problems.

Leistungsnachweis

Beleg, Klausur

4555262 Visualisierung (Visualization)

B. Fröhlich, P. Riehmann, C. Matthes Veranst. SWS: 3

Vorlesung

Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Pool-Raum 128, Übung (Bachelor), ab 24.04.2018
Di, wöch., 18:30 - 20:00, Bauhausstraße 11 - Pool-Raum 128, Übung /Lab class (Master), ab 24.04.2018
Do, wöch., 13:30 - 15:00, Bauhausstraße 11 - Seminarraum 015, Vorlesung/Lecture, ab 26.04.2018
Mi, Einzel, 10:00 - 14:00, Bauhausstraße 9a - Meeting-/Präsentationsbereich 301/302, Präsentation der Abschlussprojekte, 12.09.2018 - 12.09.2018

Beschreibung

Im ersten Teil der Veranstaltung werden die wichtigsten Verfahren und Techniken aus dem Bereich der Informationsvisualisierung für folgende Datentypen vorgestellt: multi-dimensionale und hierarchische Daten, Graphen, Zeitreihen, kartographische und kategorische Daten. Der zweite Teil beschäftigt sich mit verschiedenen Ansätzen und Algorithmen zur Visualisierung volumetrischer und vektorieller Simulations- und Messdaten. Die Veranstaltung wird englischsprachig angeboten.

engl. Beschreibung

Visualization

The first part of this course presents fundamental and advanced information visualization techniques for multi-dimensional and hierarchical data, graphs, time-series data, cartographic and categorical data. During the second half, algorithms and models for the scientific visualization of volumetric and vector-based data as well as corresponding out-of-core and level-of-detail techniques for handling very large datasets are introduced.

Various approaches presented in lectures will be studied, in part practically through labs and assignments, and with case studies. Lab classes focus on implementing, testing and evaluating the visualization approaches presented during the lectures. This course will be taught in English.

Bemerkung

Die Veranstaltung wird englischsprachig angeboten.

Voraussetzungen

Fundamental programming skills are required. Java and basic GLSL programming will be used in the lab classes. Basic computer graphics knowledge is helpful, e.g. the computer graphics course of the Medieninformatik Bachelor programme.

Leistungsnachweis

Vorlesungsbegleitende Übungen, Abschlussprojekt, mündliche Prüfung

4556105 Advanced Numerical Mathematics

K. Gürlebeck, D. Legatiuk, S. Bock Veranst. SWS: 4

Vorlesung

Mo, wöch., 11:00 - 12:30, Coudraystraße 13 B - Hörsaal 3, ab 09.04.2018
Mo, wöch., 15:15 - 16:45, Marienstraße 13 C - Hörsaal D, ab 09.04.2018
Mo, Einzel, 15:15 - 16:45, Coudraystraße 13 A - Hörsaal 2, 25.06.2018 - 25.06.2018
Do, Einzel, 09:00 - 11:00, Coudraystraße 13 B - Hörsaal 3, exam, 26.07.2018 - 26.07.2018

Beschreibung

Höhere Numerik

Effiziente Lösung linearer und nichtlinearer Gleichungssysteme;
• Diskretisierungsmethoden für verschiedene Typen partieller Differentialgleichungen
• Projektionsverfahren, Stabilität, Konvergenz und Konditionszahl
• Direkte Löser für schwach besetzte Systemmatrizen
• Fixpunktsatz, iterative Löser, Gesamtschrittverfahren, Einzelschrittverfahren, Gradientenverfahren, Relaxationsverfahren, Multiskalenmethoden und Überblick über andere Zugänge
• Eigenwertprobleme, iterative Löser
• Gebietszerlegungsverfahren

engl. Beschreibung

Advanced Numerical Mathematics

Efficient solution of linear and non-linear systems of algebraic equations;
• Discretization methods for different types of partial differential equations
• Projection methods, stability and convergence, condition number
• Direct solvers for sparse systems
• Fixed-point theorem, iterative solvers: Total step method, single step method, gradient methods, relaxation methods, multiscale methods and a survey on other approaches
• Eigenvalue problems, iterative solvers
• Domain decomposition methods

Voraussetzungen

Courses in Linear Algebra, Analysis

Leistungsnachweis

Project

Project

418110004 Don‘t get lost! Comprehensible Navigation in Immersive Virtual Reality

B. Fröhlich, A. Kulik, A. Kunert, T. Weißker Veranst. SWS: 10
Projekt

engl. Beschreibung

Don‘t get lost! Comprehensible Navigation in Immersive Virtual Reality

Have you ever lost your orientation in an unknown city? While moving through space, our brains accumulate inputs from the senses to build complex cognitive maps of the environment. In Virtual Reality, the way we navigate through large-scale scenes strongly affects this process. Physical walking through the tracking space or driving a virtual car are very comprehensible in this regard. In contrast, magic metaphors like teleportation to arbitrary locations heavily impair your spatial awareness of the environment. Commercial VR applications, nevertheless, increasingly implement teleportation variants because they rarely induce symptoms of simulator sickness.

In this project, we aim for navigation techniques that minimize the risk of simulator sickness while at the same time allowing users to maintain a high level of spatial awareness during travel. For this purpose, we will start by investigating state-of-the-art VR applications to explore the design space and parameters of navigation. Based on our insights, we will then develop novel techniques and interfaces for head-mounted displays (e.g. HTC Vive). Finally, we will reflect on our concepts by evaluating the developed techniques in a formal user study.

Learning Goals:

- discover state-of-the-art navigation techniques in Virtual Reality applications
- develop novel navigation techniques and interfaces for head-mounted displays (e.g. HTC Vive)
- structure, conduct and evaluate formal user studies in the right way
- design and give scientific presentations

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

programming skills

Leistungsnachweis

active participation in the project, intermediate talks, final presentation

418110010 Simultaneous Localization and Mapping for Unmanned Aerial Systems

V. Rodehorst, J. Kersten Veranst. SWS: 10
Projekt

Beschreibung

Die Teilnehmer werden an ein aktuelles forschungs- oder industrierelevantes Thema herangeführt. Es ist nicht beabsichtigt einen festgelegten Bereich in voller Breite zu explorieren. Stattdessen werden die Teilnehmer mit der vollen Komplexität eines begrenzten Themas konfrontiert und die Eigeninitiative gefördert. Es ermöglicht einen Einblick in die Forschungs- und Entwicklungsprojekte des Fachgebiets.

engl. Beschreibung

Simultaneous Localization and Mapping for Unmanned Aerial Systems

The participants are introduced to a current research or industry-related topic. It is not intended to explore a specific area completely. Instead, the participants are confronted with the full complexity of a limited topic and to challenge their own initiative. It allows an insight into research and development of the field.

Bemerkung

Time and place will be announced at the project fair.

Voraussetzungen

Gute Programmierkenntnisse (z.B. C/C++, MATLAB, OpenCL)

Leistungsnachweis

Aktive Mitarbeit, Einführungsvortrag, Abschlusspräsentation, Dokumentation