Vorlesungsverzeichnis

M.Sc. Digital Engineering

Sommer 2020

Stand 12.11.2020

M.Sc. Digital Engineering

Fundamentals (F)

Advanced Numerical Mathematics

4556105 Advanced Numerical Mathematics

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

Vorlesung

Mo, wöch., 13:30 - 15:00, Lecture, ab 04.05.2020
Mo, wöch., 15:15 - 16:45, Exercise, ab 04.05.2020
Mo, Einzel, 09:00 - 14:00, Coudraystraße 9 A - Hörsaal 6, Examination, 10.08.2020 - 10.08.2020

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/ Kurzkommentar

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, F. Andreussi Veranst. SWS: 4

Vorlesung

Do, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Vorlesung / Lecture (online) https://moodle.uni-weimar.de/enrol/index.php?id=21887 , ab 07.05.2020
Fr, unger. Wo, 15:15 - 16:45, Bauhausstraße 11 - Seminarraum 015, Übung / Exercise (online) https://moodle.uni-weimar.de/enrol/index.php?id=21887 , ab 08.05.2020

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/ Kurzkommentar

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

Introduction to Mechanics

420160001 Introduction to Mechanics

T. Rabczuk Veranst. SWS: 4

Vorlesung

Do, Einzel, 09:00 - 11:00, Coudraystraße 9 A - Hörsaal 6, Examination, 06.08.2020 - 06.08.2020

Beschreibung

Einführung in die Mechanik

1. Einführung in die Statik:
1.1 Kräfte und Momente
1.2 Auflagerkräfte statisch bestimmter Systeme
1.3 Schnittkräfte in Fachwerken und Balken
2. Einführung in die Elastostatik
2.1 Spannungszustand
2.2 Verzerrungszustand
2.3 Berechnung von Spannungen und Verschiebungen unter axialer und Biegebeanspruchung
2.4 Prinzip der virtuellen Arbeit

engl. Beschreibung/ Kurzkommentar

1. Introduction to statics:
1.1 Forces and moments
1.2 Reaction forces of statically determinate systems
1.3 Internal actions in pin-jointed frames and beams
2. Introduction to elastostatics
2.1 Stresses
2.2 Strains
2.3 Stresses and displacements under axial and bending loading.
2.4 Principle of Virtual Work

Leistungsnachweis

Schriftliche Klausur, 150 Minuten

Nonlinear Continuum Mechanics

Object-oriented Modeling and Programming in Engineering

Software Engineering

417290000 Software Engineering (M.Sc.)

F. Echtler, N. Ruckel Veranst. SWS: 3

Vorlesung

Di, wöch., 15:15 - 16:45, Bauhausstraße 11 - Seminarraum 013, - taught online -https://moodle.uni-weimar.de/course/view.php?id=20468 , ab 05.05.2020
Mo, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal A, 03.08.2020 - 03.08.2020
Mo, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal B, 03.08.2020 - 03.08.2020

engl. Beschreibung/ Kurzkommentar

Software Engineering (M.Sc.)

Developing software requires more than just programming skills. Answering conceptual questions is perhaps even more important than excellent knowledge of a programming language. This course introduces participants to the basics of structured software development. During the course of a larger development project, the presented techniques will be exercised in practice. Topics include all phases of the development process, such as requirements analysis, UML modelling, design patterns or agile development.

Voraussetzungen

programming skills

Leistungsnachweis

Exercise assignments + written exam

Statistics

301005 Statistics

R. Illge Veranst. SWS: 4

Integrierte Vorlesung

Di, Einzel, 09:00 - 12:00, Coudraystraße 9 A - Hörsaal 6, Examination, 11.08.2020 - 11.08.2020

engl. Beschreibung/ Kurzkommentar

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
Fr, Einzel, 13:00 - 14:30, Coudraystraße 9 A - Hörsaal 6, Examination, 14.08.2020 - 14.08.2020

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, T. Behnke, J. Wagner Veranst. SWS: 4
Vorlesung

engl. Beschreibung/ Kurzkommentar

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 (L + E)

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

Vorlesung

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 Project report + Presentation

”Advanced Modelling – Calculation/CAE” (100%) / **SuSe**

Collaborative Data Management

Computer models for physical processes – from observation to simulation

Introduction to Optimization

451002+45 Introduction to Optimization / Optimization in Applications (L)

T. Lahmer Veranst. SWS: 3
Vorlesung
1-Gruppe Mi, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 301
2-Gruppe Mi, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 302
Mo, wöch., 09:15 - 10:45

Beschreibung

Introduction to Optimization (451002):

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):

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

This course can be combined with Stochastic Simulation Techniques and Structural Reliability (L) to form a 6 CP module named Stochastic Simulation and Optimization.

Leistungsnachweis

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

”Introduction to Optimization” / (50%) / **WiSe** + SuSe

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

”Optimization in Applications” / (50%) / **SuSe** + WiSe

Macroscopic Transport Modelling

Modelling in the development process

Optimization in Applications

451002+45 Introduction to Optimization / Optimization in Applications (L)

T. Lahmer Veranst. SWS: 3
Vorlesung
1-Gruppe Mi, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 301

2-Gruppe Mi, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 302
Mo, wöch., 09:15 - 10:45

Beschreibung

Introduction to Optimization (451002):

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):

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

This course can be combined with Stochastic Simulation Techniques and Structural Reliability (L) to form a 6 CP module named Stochastic Simulation and Optimization.

Leistungsnachweis

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

”Introduction to Optimization” / (50%) / **WiSe** + SuSe

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

”Optimization in Applications” / (50%) / **SuSe** + WiSe

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

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**

Extended Finite Elements and Mesh Free Methods

Finite Element Methods (FEM)

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 (L + E)

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

Vorlesung

1-Gruppe Mo, wöch., 11:00 - 12:30, Marienstraße 7 B - Projektraum 301
1-Gruppe Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301
2-Gruppe Mo, wöch., 11:00 - 12:30, Marienstraße 7 B - Projektraum 302
2-Gruppe Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 302
Mi, Einzel, 09:00 - 11:00, Final examinationThe exam will take place in the "Weimarhalle" - Main building.Further and more detailed information will be available before the exam period., 12.08.2020 - 12.08.2020
Mo, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B
Mi, wöch., 07:30 - 09:00, Marienstraße 13 C - Hörsaal B

Beschreibung

The students will be familiar with skills and expertise in the field of nonlinear structural analyses. Extensive knowledge of theoretical basics and modern modelling methods including numerical representations are the aim of the course. The students will acquire skills in handling advanced tools for the analysis and the design of structures.

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

engl. Beschreibung/ Kurzkommentar

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

2451007 Stochastic Simulation Techniques and Structural Reliability (L)

T. Lahmer Veranst. SWS: 3
Integrierte Vorlesung
Mi, wöch., 11:00 - 12:30

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 Mrs. Terber (marlies.terber@uni-weimar.de) by briefly citing the title of the lecture and providing your name until **May 4th 2020** as this will make the organization of rooms, course material, etc. much easier.

The dates when the blocks will take place will be announced by the middle of May.

This course can be combined with Introduction to Optimization / Optimization in Applications (L) to form a 6 CP module named Stochastic Simulation and Optimization.

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

Structural Health Monitoring

Visualization and Data Science (VaDS)

Image Analysis and Object Recognition

4336010 Image Analysis and Object Recognition

V. Rodehorst, M. Kaisheva Veranst. SWS: 3
Vorlesung
Di, wöch., 09:15 - 10:45, Lecture (online) https://moodle.uni-weimar.de/course/view.php?id=19841 , ab 05.05.2020
Do, gerade Wo, 11:00 - 12:30, Lab (online) https://moodle.uni-weimar.de/course/view.php?id=19841 , ab 14.05.2020

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/ Kurzkommentar

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

Mobile Information Systems

4345560 Mobile Information Systems

F. Echtler, C. Getschmann, S. Shalawadi Veranst. SWS: 3

Vorlesung

Mi, wöch., 09:15 - 10:45, Bauhausstraße 11 - Seminarraum 014, Lecture - taught online -https://moodle.uni-weimar.de/course/view.php?id=20454 , ab 06.05.2020
Fr, wöch., 09:15 - 10:45, Karl-Haußknecht-Straße 7 - Hörsaal (IT-AP), Lab - taught online -https://moodle.uni-weimar.de/course/view.php?id=20454 , ab 08.05.2020

engl. Beschreibung/ Kurzkommentar

Mobile Information Systems

The lecture "Mobile Information Systems" focuses on the topics and issues surrounding modern mobile devices, their software and hardware and the structure of the associated networks.

Preliminary list of topics:

Overview: history & current state of mobile devices
– Hardware & related issues (power consumption)
– Software & major OSs: Android & iOS

Architecture of Mobile Networks
– 3G (UMTS) Network
– SS7 Backend Network
– Location Discovery & Queries

Service Discovery & ad-hoc networking
– „Big brother” issues
– Decentralization/P2P

Dealing with Limited Bandwidth & Connectivity
– Distributed Filesystems (Case Study: Dropbox)
– „rsync” rolling checksum algorithm
– Background: distributed databases (CAP theorem)

Exercises: Development of Android apps with
advanced features (P2P networking, location features,
NFC, ...)

Leistungsnachweis

Projektarbeit (50%) + Klausur (50%)

Photogrammetric Computer Vision

Real-time Rendering

420140001 Real-time Rendering II

R. Carmona Suju, A. Kreskowski Veranst. SWS: 3

Vorlesung

Fr, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Lecture - taught online -https://moodle.uni-weimar.de/course/view.php?id=21392, ab 08.05.2020
Mo, wöch., 09:15 - 10:45, Bauhausstraße 11 - Pool-Raum 128, Exercise Group 1 - taught online -https://moodle.uni-weimar.de/course/view.php?id=21392, ab 11.05.2020
Di, wöch., 17:00 - 18:30, Bauhausstraße 11 - Pool-Raum 128, Exercise Group 2 - taught online -https://moodle.uni-weimar.de/course/view.php?id=21392, ab 12.05.2020

Beschreibung

Ziel dieses Kurses ist es, den Studierenden die theoretischen, praktischen und technischen Grundlagen für die Auswahl, den Entwurf und die Implementierung von Echtzeit-3D-Rendering-Algorithmen und -Systemen zu vermitteln. Die Kursthemen umfassen:

- Real-time rendering pipeline
- Fast approximations of global illumination
- Efficient culling techniques
- Particle systems
- Terrain rendering
- Mesh processing and level-of-detail techniques
- Spatial acceleration schemes
- Real-time ray tracing
- Point-based rendering

Die begleitenden Übungen ermöglichen es den Studenten, eine Auswahl von Echtzeit-Rendering-Algorithmen auf aktueller Grafik-Hardware zu implementieren und zu testen. Der erfolgreiche Abschluss des Kurses Real-time Rendering I ist für die Teilnahme nicht erforderlich.

Bemerkung

Für Studierende des Studienganges "Digital Engineering" ist zusätzlich der Kurs "Real-time Rendering II - Final Project" verpflichtend zu belegen, um die notwendigen 6 ECTS zu erhalten.

Voraussetzungen

Decent programming skills are needed and in particular knowledge of C++ or Java is recommended.

However, only C++ will be used during the lab classes. Completion of the course Algorithms and Data structures or similar courses is an ideal prerequisite for successful participation.

Leistungsnachweis

Vorlesungsbegleitende, bewertete Übungen, mündliche oder schriftliche Prüfung. Ein abschließendes Projekt wird separat bewertet und erhält zusätzliche 1.5 ECTS.

Search Algorithms

Search-Based Software Engineering

Software Product Line Engineering

Visualization

420160006 Visualization - Final Project

B. Fröhlich, J. Reibert, G. Rendle, P. Riehmann Veranst. SWS: 1
Independent Study

Beschreibung

Im Abschlussprojekt der Vorlesung „Visualisierung” sollen die Teilnehmer die erlangten theoretischen und praktischen Fertigkeiten auf den Entwurf, die Implementierung und die Präsentation eines eigenständigen kleinen Forschungsprojektes anwenden. Dazu soll ein Problem ausgewählt, eine Lösung entwickelt, eine effiziente Implementierung realisiert und die Ergebnisse abschließend in einem Vortrag präsentiert werden.

Dies ist eine wertvolle Gelegenheit, an einem selbst gewählten Thema im Bereich der Visualisierung zu arbeiten.

Bemerkung

Zeit und Ort werden zur Projektbörse bekannt gegeben.

Voraussetzungen

Erfolgreiche Teilnahme an der Vorlesung „Visualization”

Leistungsnachweis

Dokumentation, Abschlusspräsentation

4555262 Visualisierung

B. Fröhlich, P. Riehmann, J. Reibert, G. Rendle Veranst. SWS: 3
Vorlesung

Do, wöch., 13:30 - 15:00, Bauhausstraße 11 - Seminarraum 015, Vorlesung/Lecture - taught online - https://moodle.uni-weimar.de/course/view.php?id=21304 , ab 07.05.2020
Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Pool-Raum 128, Übung (Bachelor) - taught online - https://moodle.uni-weimar.de/course/view.php?id=21304, ab 19.05.2020
Di, wöch., 18:30 - 20:00, Bauhausstraße 11 - Pool-Raum 128, Übung /Lab class (Master) - taught online - https://moodle.uni-weimar.de/course/view.php?id=21304, ab 19.05.2020
Mo, Einzel, 10:00 - 12:00, Marienstraße 13 C - Hörsaal B, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Bauhausstraße 11 - Seminarraum 015, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Bauhausstraße 11 - Seminarraum 014, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Bauhausstraße 11 - Seminarraum 013, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Marienstraße 13 C - Hörsaal C, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Marienstraße 13 C - Hörsaal D, 28.09.2020 - 28.09.2020

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 und mengenbasierte Daten. Der zweite Teil beschäftigt sich mit verschiedenen Ansätzen und Algorithmen zur Visualisierung volumetrischer und vektorieller Simulations- und Messdaten. Die Veranstaltung wird englischsprachig angeboten.

In den Übungen werden eine Auswahl der in den Vorlesungen vorgestellten Visualisierungsansätze umgesetzt, getestet und evaluiert. Ein separates Abschlussprojekt wird angeboten und mit zusätzlich 1,5 ETCS angerechnet.

Bemerkung

Für Studierende des Studienganges "Digital Engineering" ist zusätzlich der Kurs "Visualization - Final Project" verpflichtend zu belegen, um die notwendigen 6 ECTS zu erhalten.

Voraussetzungen

Programmierkenntnisse sowie gute Kenntnisse von Algorithmen und Datenstrukturen sind erforderlich, z.B. nachgewiesen durch den erfolgreichen Abschluss der entsprechenden Lehrveranstaltungen des Bachelor-Studiengangs Medieninformatik. In den Laborveranstaltungen werden JavaScript- und grundlegende GLSL-Programmierung eingesetzt. Grundkenntnisse der Computergrafik sind hilfreich, z.B. erworben durch die Vorlesung Computergrafik im Bachelor-Studiengang Medieninformatik.

Leistungsnachweis

Vorlesungsbegleitende, bewertete Übungen, mündliche oder schriftliche Prüfung.

Ein abschließendes Projekt wird separat bewertet und erhält zusätzliche 1.5 ECTS.

Elective Modules

205007 Modelling of steel structures and numerical simulation (L + E)

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

Vorlesung

1-Gruppe Mo, wöch., 11:00 - 12:30, Marienstraße 7 B - Projektraum 301
1-Gruppe Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 301
2-Gruppe Mo, wöch., 11:00 - 12:30, Marienstraße 7 B - Projektraum 302
2-Gruppe Mi, wöch., 07:30 - 09:00, Marienstraße 7 B - Projektraum 302
Mi, Einzel, 09:00 - 11:00, Final examinationThe exam will take place in the "Weimarhalle" - Main building.Further and more detailed information will be available before the exam period., 12.08.2020 - 12.08.2020
Mo, wöch., 11:00 - 12:30, Marienstraße 13 C - Hörsaal B
Mi, wöch., 07:30 - 09:00, Marienstraße 13 C - Hörsaal B

Beschreibung

The students will be familiar with skills and expertise in the field of nonlinear structural analyses. Extensive knowledge of theoretical basics and modern modelling methods including numerical representations are the aim of the course. The students will acquire skills in handling advanced tools for the analysis and the design of structures.

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

Di, Einzel, 09:00 - 12:00, Coudraystraße 9 A - Hörsaal 6, Examination, 11.08.2020 - 11.08.2020

engl. Beschreibung/ Kurzkommentar

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 (L + E)

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

Vorlesung

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 Project report + Presentation

”Advanced Modelling – Calculation/CAE” (100%) / **SuSe**

303001 Advanced Building Information Modelling

C. Koch, T. Behnke, J. Wagner Veranst. SWS: 4
Vorlesung

engl. Beschreibung/ Kurzkommentar

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

engl. Beschreibung/ Kurzkommentar

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

Fr, Einzel, 13:00 - 14:30, Coudraystraße 9 A - Hörsaal 6, Examination, 14.08.2020 - 14.08.2020

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

417290000 Software Engineering (M.Sc.)

F. Echtler, N. Ruckel Veranst. SWS: 3

Vorlesung

Di, wöch., 15:15 - 16:45, Bauhausstraße 11 - Seminarraum 013, - taught online -https://moodle.uni-weimar.de/course/view.php?id=20468 , ab 05.05.2020
Mo, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal A, 03.08.2020 - 03.08.2020
Mo, Einzel, 09:00 - 11:00, Marienstraße 13 C - Hörsaal B, 03.08.2020 - 03.08.2020

engl. Beschreibung/ Kurzkommentar

Software Engineering (M.Sc.)

Developing software requires more than just programming skills. Answering conceptual questions is perhaps even more important than excellent knowledge of a programming language. This course introduces participants to the basics of structured software development. During the course of a larger development project, the presented

techniques will be exercised in practice. Topics include all phases of the development process, such as requirements analysis, UML modelling, design patterns or agile development.

Voraussetzungen

programming skills

Leistungsnachweis

Exercise assignments + written exam

420140001 Real-time Rendering II

R. Carmona Suju, A. Kreskowski Veranst. SWS: 3

Vorlesung

Fr, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Lecture - taught online -https://moodle.uni-weimar.de/course/view.php?id=21392, ab 08.05.2020
Mo, wöch., 09:15 - 10:45, Bauhausstraße 11 - Pool-Raum 128, Exercise Group 1 - taught online -https://moodle.uni-weimar.de/course/view.php?id=21392, ab 11.05.2020
Di, wöch., 17:00 - 18:30, Bauhausstraße 11 - Pool-Raum 128, Exercise Group 2 - taught online -https://moodle.uni-weimar.de/course/view.php?id=21392, ab 12.05.2020

Beschreibung

Ziel dieses Kurses ist es, den Studierenden die theoretischen, praktischen und technischen Grundlagen für die Auswahl, den Entwurf und die Implementierung von Echtzeit-3D-Rendering-Algorithmen und -Systemen zu vermitteln. Die Kursthemen umfassen:

- Real-time rendering pipeline
- Fast approximations of global illumination
- Efficient culling techniques
- Particle systems
- Terrain rendering
- Mesh processing and level-of-detail techniques
- Spatial acceleration schemes
- Real-time ray tracing
- Point-based rendering

Die begleitenden Übungen ermöglichen es den Studenten, eine Auswahl von Echtzeit-Rendering-Algorithmen auf aktueller Grafik-Hardware zu implementieren und zu testen. Der erfolgreiche Abschluss des Kurses Real-time Rendering I ist für die Teilnahme nicht erforderlich.

Bemerkung

Für Studierende des Studienganges "Digital Engineering" ist zusätzlich der Kurs "Real-time Rendering II - Final Project" verpflichtend zu belegen, um die notwendigen 6 ECTS zu erhalten.

Voraussetzungen

Decent programming skills are needed and in particular knowledge of C++ or Java is recommended.

However, only C++ will be used during the lab classes. Completion of the course Algorithms and Data structures or similar courses is an ideal prerequisite for successful participation.

Leistungsnachweis

Vorlesungsbegleitende, bewertete Übungen, mündliche oder schriftliche Prüfung. Ein abschließendes Projekt wird separat bewertet und erhält zusätzliche 1.5 ECTS.

420140002 Real-time Rendering II - Final Project

R. Carmona Suju, A. Kreskowski Veranst. SWS: 1
Independent Study

Beschreibung

Im Abschlussprojekt der Vorlesung „Real-time Rendering II" sollen die Teilnehmer die erlangten theoretischen und praktischen Fertigkeiten auf den Entwurf, die Implementierung und die Präsentation eines eigenständigen kleinen Forschungsprojektes anwenden. Dazu soll ein Problem ausgewählt, eine Lösung zu entwickelt, eine effiziente Implementierung realisiert und Ihre Ergebnisse abschließend in einem Vortrag präsentiert werden.
Dies ist eine wertvolle Gelegenheit, an einem interessanten Thema Ihrer Wahl im Bereich des 3D Real-time Rendering zu arbeiten.

Voraussetzungen

Erfolgreiche Teilnahme an der Vorlesung „Real-time Rendering II"

Leistungsnachweis

Dokumentation, Abschlusspräsentation

4336010 Image Analysis and Object Recognition

V. Rodehorst, M. Kaisheva Veranst. SWS: 3
Vorlesung
Di, wöch., 09:15 - 10:45, Lecture (online) https://moodle.uni-weimar.de/course/view.php?id=19841 , ab 05.05.2020
Do, gerade Wo, 11:00 - 12:30, Lab (online) https://moodle.uni-weimar.de/course/view.php?id=19841 , ab 14.05.2020

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/ Kurzkommentar

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 (L)

T. Lahmer Veranst. SWS: 3

Vorlesung

1-Gruppe Mi, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 301
2-Gruppe Mi, wöch., 17:00 - 18:30, Marienstraße 7 B - Projektraum 302
Mo, wöch., 09:15 - 10:45

Beschreibung

Introduction to Optimization (451002):

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):

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

This course can be combined with Stochastic Simulation Techniques and Structural Reliability (L) to form a 6 CP module named Stochastic Simulation and Optimization.

Leistungsnachweis

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

”Introduction to Optimization” / (50%) / **WiSe** + SuSe

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

”Optimization in Applications” / (50%) / **SuSe** + WiSe

4526501 Academic English Part One

G. Atkinson Veranst. SWS: 2

Kurs

Mi, wöch., 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 013, ab 22.04.2020

engl. Beschreibung/ Kurzkommentar

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.

Bemerkung

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.

Voraussetzungen

Registration (compulsory)

All students must register. First time particpants are required to present the B2 English Level Certificate before the beginning of the course.

Leistungsnachweis

written examination

4526502 Academic English Part Two

G. Atkinson Veranst. SWS: 2

Kurs

Do, wöch., 17:00 - 18:30, Bauhausstraße 11 - Seminarraum 013, ab 23.04.2020

engl. Beschreibung/ Kurzkommentar

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.

Bemerkung

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.

Voraussetzungen

Registration (compulsory)

All students must register. First time particpants are required to present the B2 English Level Certificate before the beginning of the course.

Leistungsnachweis

written examination

4555211 Algorithmen und Datenstrukturen

C. Wüthrich, F. Andreussi Veranst. SWS: 4

Vorlesung

Do, wöch., 11:00 - 12:30, Bauhausstraße 11 - Seminarraum 015, Vorlesung / Lecture (online) https://moodle.uni-weimar.de/enrol/index.php?id=21887 , ab 07.05.2020

Fr, unger. Wo, 15:15 - 16:45, Bauhausstraße 11 - Seminarraum 015, Übung / Exercise (online) https://moodle.uni-weimar.de/enrol/index.php?id=21887 , ab 08.05.2020

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/ Kurzkommentar

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

B. Fröhlich, P. Riehmann, J. Reibert, G. Rendle Veranst. SWS: 3

Vorlesung

Do, wöch., 13:30 - 15:00, Bauhausstraße 11 - Seminarraum 015, Vorlesung/Lecture - taught online - https://moodle.uni-weimar.de/course/view.php?id=21304 , ab 07.05.2020
Di, wöch., 11:00 - 12:30, Bauhausstraße 11 - Pool-Raum 128, Übung (Bachelor) - taught online - https://moodle.uni-weimar.de/course/view.php?id=21304, ab 19.05.2020
Di, wöch., 18:30 - 20:00, Bauhausstraße 11 - Pool-Raum 128, Übung /Lab class (Master) - taught online - https://moodle.uni-weimar.de/course/view.php?id=21304, ab 19.05.2020
Mo, Einzel, 10:00 - 12:00, Marienstraße 13 C - Hörsaal B, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Bauhausstraße 11 - Seminarraum 015, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Bauhausstraße 11 - Seminarraum 014, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Bauhausstraße 11 - Seminarraum 013, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Marienstraße 13 C - Hörsaal C, 28.09.2020 - 28.09.2020
Mo, Einzel, 10:00 - 12:00, Marienstraße 13 C - Hörsaal D, 28.09.2020 - 28.09.2020

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 und mengenbasierte Daten. Der zweite Teil beschäftigt sich mit verschiedenen Ansätzen und Algorithmen zur Visualisierung volumetrischer und vektorieller Simulations- und Messdaten. Die Veranstaltung wird englischsprachig angeboten.

In den Übungen werden eine Auswahl der in den Vorlesungen vorgestellten Visualisierungsansätze umgesetzt, getestet und evaluiert. Ein separates Abschlussprojekt wird angeboten und mit zusätzlich 1,5 ETCS angerechnet.

Bemerkung

Für Studierende des Studienganges "Digital Engineering" ist zusätzlich der Kurs "Visualization - Final Project" verpflichtend zu belegen, um die notwendigen 6 ECTS zu erhalten.

Voraussetzungen

Programmierkenntnisse sowie gute Kenntnisse von Algorithmen und Datenstrukturen sind erforderlich, z.B. nachgewiesen durch den erfolgreichen Abschluss der entsprechenden Lehrveranstaltungen des Bachelor-Studiengangs Medieninformatik. In den Laborveranstaltungen werden JavaScript- und grundlegende GLSL-Programmierung eingesetzt. Grundkenntnisse der Computergrafik sind hilfreich, z.B. erworben durch die Vorlesung Computergrafik im Bachelor-Studiengang Medieninformatik.

Leistungsnachweis

Vorlesungsbegleitende, bewertete Übungen, mündliche oder schriftliche Prüfung.

Ein abschließendes Projekt wird separat bewertet und erhält zusätzliche 1.5 ECTS.

4556105 Advanced Numerical Mathematics

K. Gürlebeck, D. Legatiuk Veranst. SWS: 4
Vorlesung
Mo, wöch., 13:30 - 15:00, Lecture, ab 04.05.2020
Mo, wöch., 15:15 - 16:45, Exercise, ab 04.05.2020
Mo, Einzel, 09:00 - 14:00, Coudraystraße 9 A - Hörsaal 6, Examination, 10.08.2020 - 10.08.2020

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/ Kurzkommentar

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

301015 Interpolation with solutions of partial differential equations

K. Gürlebeck, S. Bock Veranst. SWS: 10
Projekt

Beschreibung

Modern measuring methods, such as terrestrial laser scanning techniques or photogrammetric methods, enable the high-precision detection of deformed component surfaces by using a large number of spatial measuring points.

This results in the problem of reconstructing the displacement field and the stresses in the interior of the component on the basis of the discrete measured values on the surface. To this end, the project aims to develop multivariate interpolation methods with solutions of partial differential equations (Laplace equation, Lamé-Navier equation). Furthermore, these methods are to be implemented prototypically and evaluated for simple domains.

Voraussetzungen
- Successful completion of the modules
  o Applied Mathematics & Stochastics
  o Advanced Modelling – Calculation / CAE Good
- knowledge of programming, especially the implementation of mathematical algorithms
- Experienced in the use of mathematical calculation software (Matlab, Octave, Maple o.a.)

302010 Development and validation of an algorithm to analyze schlieren images

C. Völker, V. Rodehorst Veranst. SWS: 10
Projekt

Beschreibung

Schlieren imaging system is a flow visualizing technique. It is used to visualize density variation in transparent media. Schlieren imaging capitalizes the refraction of light. It makes small density gradients (e.g. weak gradients of refractive index found in indoor air) visible. For this project, the schlieren imaging system at the Department of Building Physics will be used. The setup consists of four elements, (1) single concave spherical mirror, (2) LED light source, (3) knife-edge and (4) a digital camera. The setup will be used to capture schlieren images. Large time-sequence of these images would be analyzed using digital cross-correlation algorithm to quantify the velocity, temperature, density gradient, refractive index, etc. of the test object.

Voraussetzungen
- Successful completion of Image Processing and Computer Vision.
- Simulation Methods in Engineering (additional)

303010 Virtual Mechanics Lab

C. Koch, J. Krischler Veranst. SWS: 10
Projekt

Beschreibung

AR and VR offer excellent opportunities for integration into university teaching for engineers because they address human image processing. Image processing supports the human mind in forming a mental model, i.e. in forming a deep understanding of the subject matter. A good learning scenario must include fixed learning goals that are to be achieved by completing the AR/VR app. The learning scenario must be implemented in a visually appealing way and in consideration of psychological concepts. Implementation requires not only an understanding of the concepts to be implemented, but also the ability to implement them in the respective programs.

Voraussetzungen
- Knowledge in Unity (optional)
- Knowledge in programming (Python or C#)
- Knowledge in visual scripting (e.g. Dynamo, Grasshopper) (optional)
- Advanced knowledge in mechanics

303011 Collaborative BIM Platform

C. Koch, M. Artus Veranst. SWS: 10

Projekt

Beschreibung

The whole process of construction is based on a building information model. Multiple actors with different jobs and hence different rights, views and documents work on a single project. We want to merge the model and related documents in a single system for teaching purposes. Basic open software already exists. To implement and test an advanced overlay and communication is the goal of the project.

Voraussetzungen
- programming knowledge (object-oriented modeling and programming or similar)
- knowledge in Building Information Modeling (Advanced BIM or similar)
- Web technologies (REST, JSON, Server, Client, ...)

303012 Virtual Bridge Inspection

C. Koch, M. Artus Veranst. SWS: 10
Projekt

Beschreibung

It is possible to capture current bridge condition via unmanned aerial systems. However, it is still necessary to assess the data by an engineer. A combination of both, on side inspection by drones and assessment in office by an engineer, we want you to implement and validate a virtual bridge inspection environment. First, loading the bridge data into unity. Afther that, the engineer shall be able to add damages to the bridge and finally export the data again.

Voraussetzungen
- programming knowledge (object-oriented modeling and programming or similar)
- knowledge in Building Information Modeling (Advanced BIM or similar)
- Optional: Knowledge in Unity and C#

401021 Development of a software tool for a 2D structural frame analysis

C. Könke, A. Habtemariam Veranst. SWS: 10
Projekt

Beschreibung

The project is to develop a software tool which can assess the behavior of a simple 2D frame structure and compute stepwise and interactively the internal forces using different solution techniques such as nodal equilibrium method, flexibility method and stiffness method.

The program should include a Graphical User Interface (GUI), which allows the user to intuitively define an input, presents detailed solution steps for checking manual hand calculations and plots the internal forces and displacements.

Voraussetzungen
- programming knowledge in Octave or MATLAB or Maple
- knowledge in Structural Mechanics
- basics of Finite Element Methods

420110009 Combined Camera and Projector Calibration for Real-time Tracking and Mapping

V. Rodehorst, J. Hüfner

Projekt

Beschreibung

The project is a cooperation between the professorships of computer vision and
cross media moving images of visual communication (faculty art & design).
There exist a modular, interactive screen with 12 cubes (50×50×50cm) for performances or an interactive user experience. Every cube side can have an own video and you can turn a cube to show a new video or put di#erent cubes together. Currently, the tracking of the cubes works with ultraviolet markers which are only visible with uv-light. The actual challenge is the calibration of the tracking camera and the projector.
The project goals consist of the evaluation of the setup (Unity + Vuforia), the understanding of internal and external tracking data, the calibration of camera and projector as well as optimizing the quality of tracking.

Bemerkung

Zeit und Ort werden zur Projektbörse bekannt gegeben.

Voraussetzungen

Successfully completed course Photogrammetric Computer Vision
Experience with Unity and Vuforia is helpful

420110019 How to add MY gadgets? Exploring smart home topologies to discover and integrate devices

S. Lucks, F. Echtler, N. Lang, S. Shalawadi Veranst. SWS: 10
Projekt

engl. Beschreibung/ Kurzkommentar

The Internet of Things (IoT) developed itself from an upcoming trend to a present instance in our every-day lives. While more and more people enjoy talking to Alexa or Siri or automating their homes,
many people are still skeptical, especially when it comes to terms related to privacy and security.
In this project, we want to implement different variations of a protocol that allows us to integrate only trusted devices to our network.
Afterward, we want to evaluate the protocols and the implementations to relate a conclusion towards securing out IoT networks.

Bemerkung

Zeit und Ort werden zur Projektbörse bekannt gegeben / Time and place wil be announced on the project fair

Voraussetzungen

Bachelor: Kryptographie und Mediensicherheit, Webtechnologie; Master: mindestens eine Krypto-Veranstaltung (z.B. Introduction to modern Cryptography)

Leistungsnachweis

Midterm presentation; Final presentation; Documentation (scientific paper)

420110022 Separation of Reflectance Components

V. Rodehorst, P. Debus, M. Kaisheva Veranst. SWS: 10
Projekt

Beschreibung

Die visuelle Erscheinung der meisten Echtweltobjekte lässt sich maßgeblich mithilfe von diffusen und spekularen Relexionskomponenten beschreiben. Die korrekte Modellierung von Materialeigenschaften erlaubt dann eine bessere Oberflächenrekonstruktion der Geometrie, sowie realistische Nachbeleuchtung deren virtueller Repräsentationen (z.B. in VR-Umgebungen). Unser Ziel in diesem Projekt ist es die, diese Komponenten für undurchsichtige Objekte möglichst genau aus Bildern zu berechnen. Um dies zu erreichen werden wir allgemeingültige Materialrekonstruktionsalgorithmen auf Basis verwandter Arbeiten wissenschaftlich analysieren, weiterentwickeln, implementieren und die Ergebnisse letztendlich evaluieren.

engl. Beschreibung/ Kurzkommentar

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

Zeit und Ort werden zur Projektbörse bekannt gegeben / Time and place will be anounced on the projecr fair

Voraussetzungen

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

Leistungsnachweis

Aktive Mitarbeit, Einführungsvortrag, Abschlusspräsentation, Dokumentation

901716 Implementation and validation of a shake table for structural health monitoring and control

K. Smarsly, S. Ibañez Sánchez Veranst. SWS: 10
Projekt

Beschreibung

Design of civil infrastructure involve assumptions of material characteristics, assumption of loading conditions, and assumptions of structural behavior. However, some uncertainties regarding structural behavior can be reduced by using scaled models. In the case of earthquake engineering, knowing the structural behavior under seismic events allow engineers to improve models and produce more accurate designs. In this context, shake tables are used for scaling and simulating earthquakes in scaled models. However, shake tables are usually expensive and difficult to operate. The proposed project is centered around shake tables. The main objective of this project is to produce a low-cost shake table able to simulate earthquake events for scaled structures. The implementation of the shake table involves several steps: - Elaborate a literature review regarding low-costs shaking tables - Summarize the scaling process of earthquake movements - Elaborate a budget of the materials needed for creating a shaking table - Create the shaking table - Program the shaking table for reproducing scaled earthquakes based on input text files with earthquake records The outcome of the project will be a low-cost shake table able to reproduce scaled earthquakes for any scaled structure. A real-time evaluation of the produce earthquake should be accomplished by measuring the movement of the shake table using accelerometers and deviations of the movement should automatically corrected by the shake table. In parallel to the special project, attendance to the ”Scientific working in computational engineering” lecture is compulsory. The basics concepts required for working and documenting scientific works will be obtained during the lecture. Integrated lecturesIntegrated

Voraussetzungen

- Programming skills
- Basics of earthquake engineering
- Basic knowledge on scientific writing