

BIWO-04: Software Engineering (Prof. Scherer/Dr. Reuter)

Contents of part Software Systems (Prof. Scherer)

- 1) Management Information Systems
 - Introduction
 - definition of MISs
 - definition of systems
 - overall process of an engineering system treatment
 - different views of systems
 - System capturing - Formal representation of systems in IDEF0
 - applications of IDEF0
 - structure of IDEF0-diagrams
 - basic elements
 - decomposition in sub-systems
 - bundling and unbundling of data
- 2) Object-oriented modelling of complex engineering systems using EXPRESS-G
 - scope of different modelling techniques
 - paradigm of object-oriented data modelling
 - basic elements
 - concept of inheritance
- 3) Transformation of the conceptual data model in a relational database model
 - basic concepts of the relational data model
 - different relation types of the relational data model
 - approximate realization of the concept of inheritance
- 4) Communication and data exchange
 - human to human communication
 - machine to machine communication
 - human to machine communication
 - XML / XSD
- 5) Monitoring and system identification
 - monitoring requirements and methods
 - monitoring data processing
 - system identification strategies
 - system dependencies
- 6) Monitoring – Extension of data model
 - bare system
 - system data model extension

Prerequisite Knowledge

- Basic knowledge in spread sheet applications

Topics of Project and Master Thesis

- In general:
 - Development of computer-based methods for managing information from the field of civil engineering

- In particular:
 - Development of an user-oriented query language for civil engineers to manage IFC-based building information
 - Integration of cross-domain model data into the IFC schema using existing IFC concepts

Literature

- C. Eastman: Building Product Models: Computer Environments Supporting Design and Construction, CRC Press, Boca Raton FL, 1999
- D. Schenk, P. Wilson: Information Modelling the EXPRESS Way, Oxford University Press, 1994
- Standard for Integration Definition for Function Modeling (IDEF0), NIST, Gaithersburg, US, 1993, <http://www.iedf.com/pdf/iedf0.pdf>
- Syntax and Semantics for IDEF0. 1998, <http://ieeexplore.ieee.org/jel4/6054/16180/00749110.pdf>

Contents of part Numerical Methods (Dr. Reuter)

- 1) Introduction to Numerical Analysis
 - types of algorithm
 - stability of algorithm
 - condition of problems
- 2) Programming with Fortran 90/95
 - structure of a program
 - basic elements
 - declaration of variables
 - arithmetic and logical operators
 - conditional statements and loops
 - input and output
- 3) Linear Algebra
 - Vector calculus
 - Matrix calculus
 - Systems of linear equations
 - Specific eigenvalue problem
 - Generalized eigenvalue problem
- 4) Systems of nonlinear equations
 - Bisection method
 - Secant method
 - Regula falsi method
 - Newton's method
- 5) Numerical integration
 - Quadrature rules based on interpolating functions
 - Monte Carlo integration (simulation)
- 6) Approximation
 - function approximation
 - approximation of discrete data

- interpolation vs. regression analysis
 - polynomial interpolation vs. spline interpolation
- 7) Computer graphics
- Coordinate transformation
 - Projection

Prerequisite Knowledge

- Basics in differential calculus, integral calculus, and linear algebra

Topics of Project and Master Thesis

- In general: - Efficient meta-model based methods for global sensitivity analysis of complex non-linear systems
- In particular: - Evaluation of different factors effecting neural networks as function approximators
- Evaluation of the influence of neural network architecture on sensitivity measures

Literature

- R. Kress: Numerical Analysis, Springer, New York Berlin Heidelberg, 1998
- D. V. Griffiths, I. M. Smith: Numerical methods for engineers – a programming approach, Blackwell Scientific, London, 1991