



## Model-Driven Software Development in Technical Spaces (MOST) - Heterogeneous Software Factories -

### Announcements

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# Welcome to the MOST course!

## Relation of the Course to Modules

The course can be used for the following modules:

- ▶ Diplom Informatik: INF-BAS3, INF-VERT3
- ▶ Master Informatik: INF-BAS3, INF-VERT3
- ▶ Bachelor Medieninformatik: INF-B-540
- ▶ Master Medieninformatik: INF-BI-4, INF-BI-5
- ▶ Diplom IST: IST-B-321
- ▶ Diplom Informatik (2004): INF-04-FG-SWT
- ▶ Diplom Informatik (2004): FG 4 SE
- ▶ Master Distributed Systems Engineering (DSE)
- ▶ Master Computational Modeling and Simulation (CMS)

For other programs, special rules may hold; consult the manuals of your "Nebenfach".



## Master's Courses (Hauptstudium)

3 Model-Driven Software Development

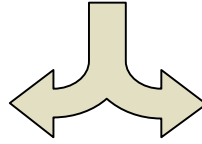
**Softwaretechnologie II (Bachelor)**  
Modellierung, Entwurfsmethoden,  
Produktlinien, Geschäftsmodelle (WS)

**Model-Driven Software  
Development in Technical Spaces**  
How to be productive in software  
development (WS)

**Requirements Engineering  
und Testen (Dr. Demuth)**  
Wie man Qualität für Software  
erzielt (WS)

**Ausgewählte Kapitel aus  
der Softwaretechnik  
(Dr. Götz)**  
Softwarearchitektur (SS)

**Future-Proof Software  
Systems (Prof. Furrer)**  
Evolvable architectures (WS)



**Design Patterns and  
Frameworks**  
Architektur objektorientierter  
Systeme (WS)

**Component-Based  
Software Engineering**  
Product lines with component  
models (SS)

**Automotive Software  
Engineering  
(Dr. Conrad) (SS)**

**Academic Skills in Software  
Engineering**  
How to work scientifically (SS)  
(Dr. Götz)

**Software-Management**  
Wie man Projekte macht (SS)  
(Dr. Demuth)

**Softwareentwicklung in der  
industriellen Praxis**  
Ringvorlesung mit  
Industrieexperten

**Software as a Business  
(WS)**  
How to develop a business model  
and a startup

## Lecturing – How in Corona-Times?

- ▶ We will start with presence teaching and film a video
- ▶ If Aßmann catches a cold, there might be sudden changes
  - Then, lecture films from home
  - Lecture dates will morph to question hours
  - People may ask questions via a video conference room
  - <https://www.gotomeet.me/UweAssmann>

# Central Topics of the Course

6. Advanced Topics in Modeling	<b>Melanie Deep Modeling</b>
5. Integration of Tools and Macromodels in Multi-TS Software Factories	<b>Transformation Bridge Adapter Bridge</b>
4. Technical Space GraphWare and its languages	<b>Datalog Graph Transformation</b>
3. Macromodels as the core of homogeneous, One-TS Software Factories	<b>MDA OSM ROSI</b>
2. Technical Space TreeWare and its languages	<b>Tree Grammars Ref. Attr. Grammars</b>
1. Classic Metamodeling Metamodels structure languages, data, models and programs Tool Construction and -Generation in a Technical Space	<b>EMFText eMOFlon</b>
0. Basics: Applications of MDSD: Design tools of complex systems, Design tools for CPS	<b>EMOF MOF EMOF CROM</b>



- ▶ MDSD is the engineering of applications with *several related models* (inclusively code), based on systematic engineering of metamodels (languages) in technical spaces.
- ▶ MDSD therefore treats *heterogeneous models*
  - Treating different aspects of a system
  - Specified in different modeling languages
  - Living in different *technical spaces*
- ▶ How are models related?
  - Model cover by matching rules
  - Model mappings
  - Model transformations
- ▶ How are the languages related?
  - By mapping
  - By role fattening
- ▶ How are the technical spaces related?
  - By macromodelling



- ▶ Def.: A **multimodel** is a set of correlated models.
- ▶ Def.: A **macromodel** is a set of *systematically* related, heterogeneous models.
  - Macromodelling treats heterogeneity
  - Requires model integration techniques
- ▶ Engineering of Technical Spaces and macromodels is one of the most important topics of the future of software and systems development
- ▶ Dresden has modern technologies and tools based on macromodels
  - Role-and context-based languages (CROM, SCROLL)
  - Invasive composition (SkAT)
  - Metacomposition tools (Reuseware, SkAT, Style Sheets)
  - Round-Trip Engineering and Role-based tools



## Part 0: Basics

- ▶ 1. Modeling in MOST (MDSO)
- ▶ 2. MDSO Applications
- ▶ 3. Context and Roles in Modelling

## Part I: Classic Metamodeling

- ▶ 10. Metamodeling in the (E)MOF technical space
  - The Technical Space House
- ▶ 11. Bridging the TS Grammarware and EMOF with EMFText
- ▶ 12. Technical Spaces and Software Factories
- ▶ 13. Structure of M2

## Part II: Treating heterogeneity in TreeWare

- ▶ 20. Grammarware: Parser generators, Text algebrae
- ▶ 21. Treeware: Query
- ▶ 22. Deep Analysis in Treeware
  - Abstract interpretation
- ▶ 23. Link-Treeware
  - XML, JSON, Xcerpt

## Part III: Macromodels in 1-TS Software Factories

- ▶ 30. Requirements, Documentation and Test Management in a macromodel
- ▶ 31. Model-Driven Architecture
- ▶ 32. Single Underlying Model (SUM) and Skeleton-SUMs
- ▶ 33. Stream-based integration





# Outline Part IV-VII – Architecture of Software Factories

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Model-Driven Software Development in Technical Spaces (MOST)

## Part IV Treating heterogeneity in GraphWare

- ▶ 40 Flat Analysis in Graph- and Modelware
  - Semmle .QL, TGreQL
- ▶ 41 Deep Analysis in Graphware
  - Reachability
- ▶ 42 Graph and Model Transformations
- ▶ 43. MetaCASE tools (MetaEdit+)
- ▶ 44. MOFLON as example
- ▶ 45. Smart applications (SMAGs)
- ▶ 46. Fujaba

## Part V: Architecture and Composition of Tools to Applications

Tool integration, Exchange formats, Bridges between technical spaces, Composition of stream-based tools

- ▶ 50. Tools-and-Materials Pattern Language
- ▶ 51. Role-based composition of languages for the composition of materials
- ▶ And tools
- ▶ 52. Role-based repository architecture
- ▶ 53. Material-exchange and Stream-Based integration
- ▶ 54. Synchronization and Round-Trip Engineering with Triple Graph Grammars

## Part VI: Advanced Modeling

- ▶ 60. Orthographic Software Modeling
- ▶ 61. 2-d-Software Modeling

## Part VII: Multi-TS Software Factories

- ▶ 70. Large Software Factories



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