
Embedded Systems Design

Design of Embedded Systems/Model-Based

- Covers the main stages in the development of embedded systems, with emphasis on model-based development and formal methods for the analysis of system properties.
- We review problems and approaches related to all the stages of development including
 - requirements analysis,
 - system-level design (UML and SysML),
 - component oriented modelling, (AUTOSAR)
 - behavioural modelling, (FSM-Simulink)
 - verification of properties, architecture selection and design,
 - code generation and testing.
- Hands-on approach, use of tools, use of embedded boards
 - UML/SysML – Papyrus
 - Simulink/Stateflow

Design of Embedded Systems/Model-Based

- Boards



STM32F4



STM32F7

Course Plan

- Intro to ES, V-model and Model-based Design
- *Project intro*
- Requirements and Functional Testing
- *Project step1 – Requirements and test plan*
- Models and systems
- FSMs part1
- Communication buses – event driven - Controller Area Network
- *Project step2 – Intro to Flex, programming IDE, Erika, Device drivers*
- FSMs part2
- Communication buses – time driven – FlexRay
- FSMs part3
- Extensions to FSMs – Statecharts
- *Project step3 – Models*
- Timed automata
- An Introduction to Uppaal and verification
- *Project step4 – Verification*
- Translating an FSM into code: Part 1
- Statecharts in practice – Mathworks Stateflow
- Translating an FSM into code: Part 2
- Automatic code generation with Mathworks tools
- *Project step5 – Production of Code*
- Conformance testing
- Structural testing – coverage
- *Project step6 – Testing*
- Advanced topic: semantics preservation in multiprogramming implementations
- Advanced topic: component-based design and AUTOSAR

Course Plan

retis.sssup.it/~marco/teaching/embeddedsystems/lessons/

Scuola Superiore Sant'Anna
 INSTITUTE OF COMMUNICATION, INFORMATION AND PERCEPTION TECHNOLOGIES
 Scuola Superiore Sant'Anna

Research Teaching Personal Contact

Embedded Systems - Model-Based Design

Lessons - Handouts

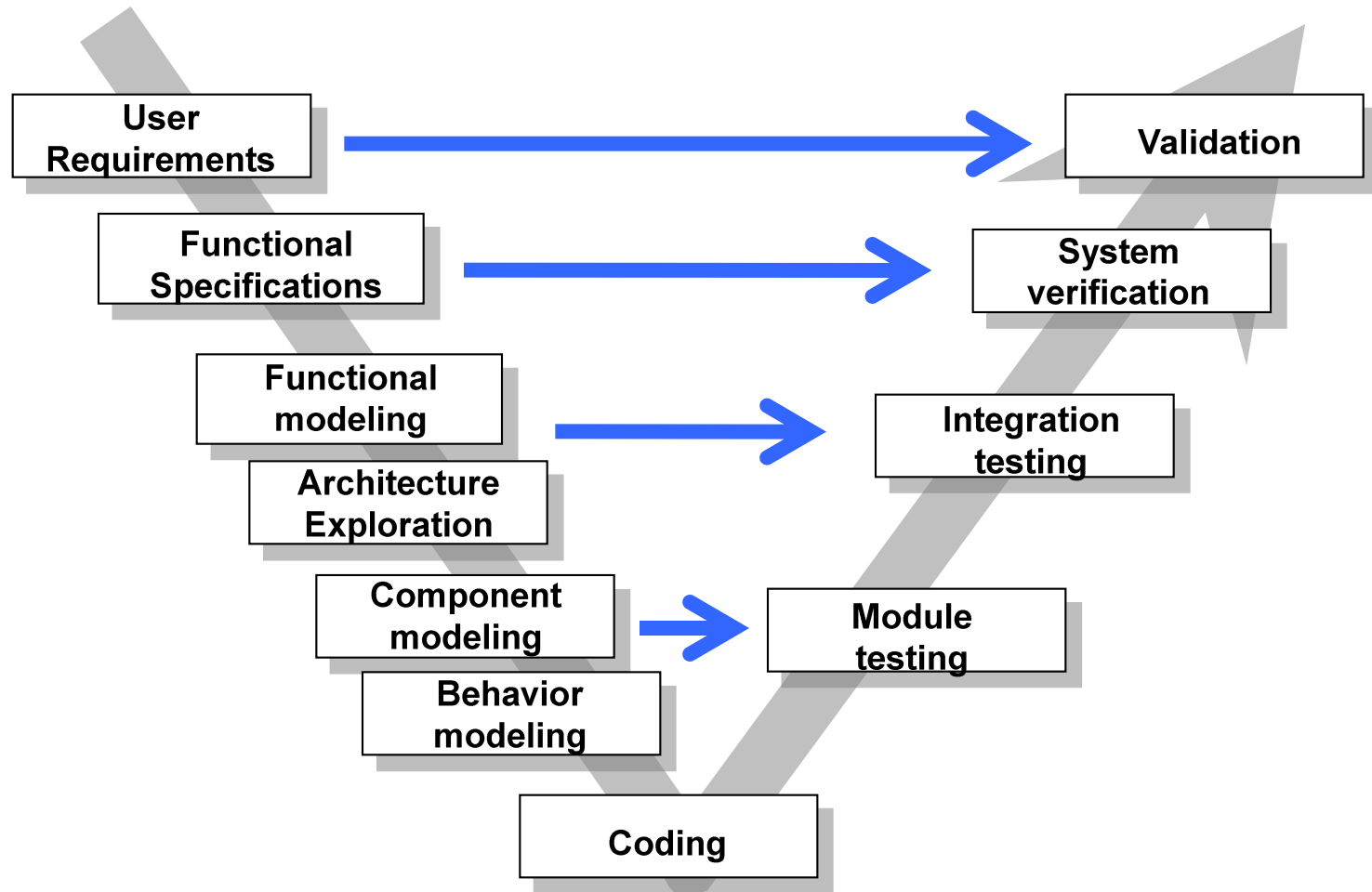
Lesson	Description	Slides	Video	Add. Material
0 Introduction	Course layout and contents, prerequisites, the development process			
1 Requirements Analysis	Requirements in the development process, how to write requirements, tracing requirements to test and design			
2 SysML	The SysML modeling language, metamodel, diagrams, blocks and BBDs. Introduction to Papyrus		1:17:21 Intro to SysML and Papyrus, models and metamodel, structure diagrams 26:20 Structure diagrams, blocks, BDDs and IBDs 1:16:15 Model examples, ports, intro to profiles 55:35 Profiles and stereotypes for platform and SW architecture 26:24 Profiles, stereotypes and Mapping 52:16 SysML diagrams for behavior modeling	Book reference links_papyrus models
3 Functional testing	introduction to functional (black-box) testing		39:44 Functional testing	
4 Introduction	Introduction to Simulink models,		36:58 Introduction to Simulink 1:35:20 Simulink execution	Models_examples

Quick links
[Courses](#)
[Research](#)
[Projects](#)
[Publications](#)
[Exams](#)
[Links](#)

Course organization and evaluation

- Evaluation is based on
 - Project: development of simple application on Flex board using model-based derivation techniques. Teams of 4. Each member of the team must be capable of discussing the project steps. 40%
 - Final test - written 30%
 - Final test - oral 20%
- Available Projects
 - Elevator controller mockup (all)
 - Elevator subsystem (pick one)
 - Interface prototyping (Linux with Qt or Microchip)

The V-shape development cycle (V-model)



End of introduction

- Questions/Issues?