Course Organization

Model-based Design of Cyber-physical Systems

Benny Akesson & Andy Pimentel

University of Amsterdam

ESI

An initiative of industry, academia and TNO

Course Team

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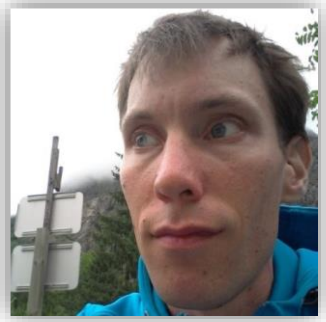

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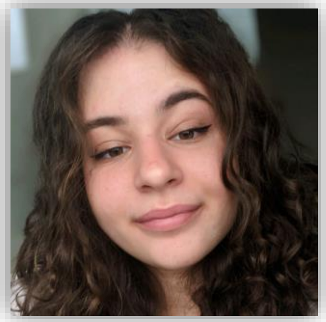

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Intended Learning Outcomes

You will be able to …

1. explain the key characteristics of cyber-physical systems
2. specify aspects of cyber-physical systems at different levels of abstraction
3. functionally verify weak termination of systems using methods based on Petri Net models
4. verify schedulability of periodic tasks and perform cache analysis on a single-core system, and explain the added challenges in a multi-core system
5. explain how design-space exploration identifies hardware and software configurations that satisfy multi-dimensional constraints on e.g. cost, performance and energy consumption
6. work together in a team to develop software that satisfies its requirements on a given cyber-physical system

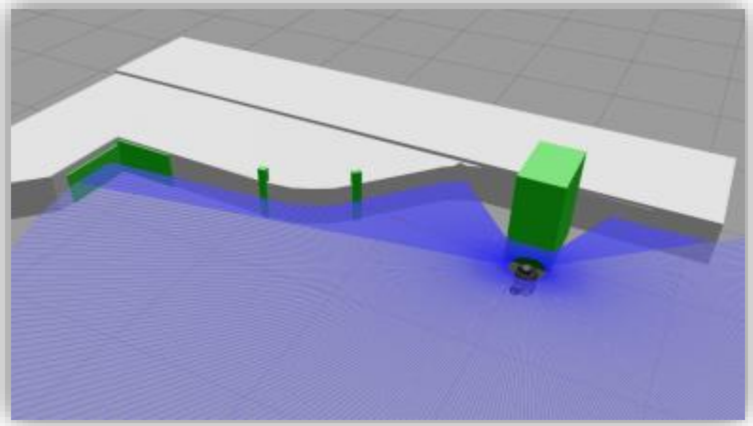
Course Modules

1. **Introduction to Cyber-physical Systems**
2. **Modelling Cyber-physical Systems**
    - E.g. Statecharts and Petri Nets
3. **Domain-specific Languages**
4. **Embedded Systems Hardware**
5. **Timing Verification**
    - Timing analysis and schedulability analysis in single-core systems
    - Performance engineering in distributed cyber-physical systems
6. **Application Mapping and Design-space Exploration**

Course Project

Practical Project (50% of final grade)

- TurtleBot Burger programmed using Yakindu Statecharts Tool
- Application is to **navigate and map** a ventilation system (maze)
- Use of both **simulation** and **physical robot**



Group work

- Groups with 4-5 members (aim for 4)
- Group members get same grade
- Must be ≥ 5 to pass

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Assignments

3 Assignments (50% of final grade)

1. **Modeling Embedded Systems** (individual)
2. **Domain-specific Languages** (pairs)
3. **Timing Verification** (individual)

Grading Policy

- Result is **average** over all 3 graded assignments
- We check submitted assignments for **plagiarism**

Course Structure

The aim is to give the course physically at Science Park

12 Lectures (2 per week)

- **Wednesdays 09:00 – 11:00** and **13:00 – 15:00** in **random rooms** (check Datanose)

14 Practical sessions (2 per week)

- **Wednesday 11:00-13:00** and **Thursday 09:00-15:00** in **random rooms** (check Datanose)
- Teaching assistants will be available to help with course assignments and project

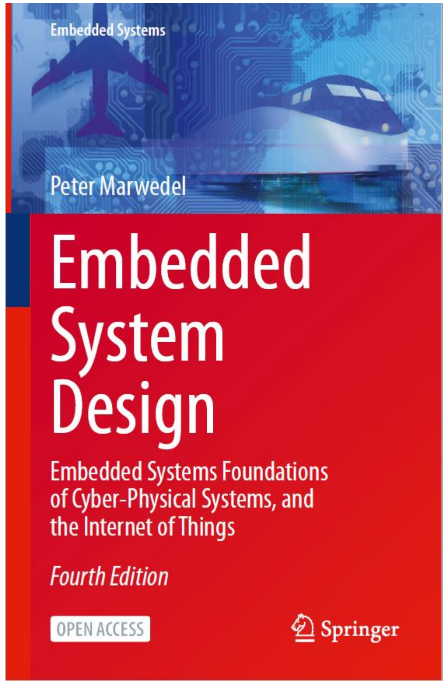
Course Material

The course material needed for this course is available on Canvas

- Slides are posted after every lecture

The main theoretical material is covered by the slides

- Supporting material in form of a book and papers
- Reading optional material is good for you



Supported Communication Outside Scheduled Activities

Personal questions

- By e-mail to relevant lecturers or teaching assistants (see Slide 2)

Informal communication

- Slack channel #cps

Official questions about assignments or project

- Discussions on Canvas