DD2415 Safe Robot Planning and Control 6.0 credits

Säker robotplanering och styrning

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

This official course syllabus is valid from the autumn semester 2022 in accordance with decision M-2021-1696 by the Dean of the ITM School: J-2021-1957.Decision date: 14/10/2021

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Computer Science and Engineering

Specific prerequisites

Knowledge in introduction to robotics, 7.5 higher education credits equivalent to completed course DD2410.

Active participation in a course offering where the final examination is not yet reported in LADOK is considered equivalent to completion of the course.

Registering for a course is counted as active participation.

The term 'final examination' encompasses both the regular examination and the first re-examination.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the student shall be able to

- Account for and apply different principles of robot planning and control.
- Formulate a planning and control problem for a given robotic application.
- Select and motivate appropriate techniques for robot planning and control for various contexts and domains.
- Analyze and evaluate safety of a given robotic system.

Course contents

- Introduction to safety of robotic systems, techniques and approaches.

- Safety/reachability analysis, safe set representation and reachability analysis for dynamical systems.

- Safe robot control, invariant sets, potential fields and control barrier functions.

- Fail-safe and risk-aware planning.

- Advanced motion planning algorithms, feedback motion planning, sampling-based motion planning under differential constraints, trajectory optimization.

- Task planning and integrated task and motion planning.

- Formal methods for robot planning and control. Discrete- and continuous-time temporal logics for goal and constraint specification. Correct-by-design planning and control.

- Reinforcement learning for robot control, reinforcement learning for planning under uncertainty, safe reinforcement learning.

Examination

- LAB1 - Laboratory work, 2.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB2 - Laboratory work, 2.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB3 - Laboratory work, 2.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.