ÖREBRO UNIVERSITET

Robot Manipulation Control, 7.5 credits

Reglerteknik för objekthantering med robotarm, 7,5 hp

Course Code/Codes	50DT060
Subject Area	Computer Science (Datavetenskap)
School/equivalent	School of Science and Technology (Institutionen för naturvetenskap och teknik)
Valid from	2021-05-10
Approved	2021-06-02
Revised	
Approved by	Head of School
Translation to English, date and signature	N/A

1 Course content

The course covers the following topics:
- kinematic and dynamic models of robot arms
- common motion control schemes applied to robotic systems
- overview of interaction control schemes (force control, impedance control)
- implementation of robot control schemes
- evaluation and tuning of control modules
- interaction between low- and high- level control modes
- recent advances of sensorimotor control policy learning and their applications to robot manipulation

2 Outcomes

2.1 The course in relation to the doctoral programme

The course shall primarily refer to the following intended learning outcomes for third-cycle courses and study programmes as described in the Higher Education Ordinance, i.e. the doctoral student shall demonstrate:

Knowledge and understanding
- broad knowledge and systematic understanding of the research field (part of outcome 1)
- advanced and up-to-date specialised knowledge in a limited area of this field (part of outcome 1)
- familiarity with the methods of the specific field of research in particular (part of outcome 2)

Competence and skills
- the capacity for scholarly analysis and synthesis (part of outcome 3)
- the capacity to review and assess new and complex phenomena, issues and situations autonomously and critically (part of outcome 3)

- the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively (part of outcome 4)
- the ability to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames (part of outcome 4)

Judgement and approach
- intellectual autonomy and disciplinary rectitude (part of outcome 9)

The intended learning outcomes are listed in the same order as in the general syllabus for the programme.

2.2 Intended course learning outcomes

To obtain a passing grade, the doctoral student shall demonstrate:

knowledge of modern robot control methods (outcome 1)
- ability to implement and evaluate robot control methods applied to manipulation (outcome 2)
- capacity to analyze results and performance of state of the art and recent research methods (outcomes 3 and 9)
- ability to replicate research, carry out evaluations, critically analyze the implications and present findings within specified time frames (outcomes 2,3 and 4)
- a capacity to reason about limitations and advantages of different controllers in different application contexts (outcomes 3 and 4)
- an ability to discuss common practices and algorithms to implement these controllers (outcomes 3 and 4)

3 Reading list and other teaching material

The following course readings and teaching material will be used on the course:

Bruno Siciliano, Lorenzo. Sciavicco, Luigi Villani and Giuseppe Oriolo (latest edition) Robotics: modelling, planning and control Springer Science & Business Media

4 Teaching formats

Teaching on the course takes the following format:

form of a series of seminars.

5 Examination

The course is assessed through an examination in the format of

- an oral examination in the form of a project presentation. Through the presentation, the doctoral student is expected to demonstrate attainment of the intended learning outcomes related to outcomes 1,2,3 and 4.
- a written project report. Through the report the doctoral student is expected to demonstrate attainment of the intended learning outcomes related to outcomes 1,2,3,4 and 9.

For examinations consisting of several examination components, the following applies: If during the course it is concluded that a doctoral student is unable to complete a certain examination component, the examiner may set a substitute assignment provided that circumstances do not reasonably allow for the course component to be completed at a later date during the run of the course.

6 Grades

Examinations on third-cycle courses and study programmes are to be assessed according to a two-grade scale with either of the grades 'fail' or 'pass' (local regulations).

The grade shall be determined by a teacher specifically nominated by the higher education institution (the examiner) (Higher Education Ordinance).

To obtain a passing grade on examinations included in the course, the doctoral student is required to demonstrate that he/she attains the intended course learning outcomes as described in section 2.2. Alternatively, if the course consists of multiple examinations generating credit, the doctoral student is required to demonstrate that he/she attains the outcomes that the examination in question refers to in accordance with section 5.

A student who has failed an examination is entitled to a retake.

If an examination consists of several examination components, and a student fails an examination component, the examiner may, as an alternative to a retake, set a make-up assignment with regard to the examination component in question.

A doctoral student who has failed an examination twice for a specific course or course element is entitled, upon his/her request, to have another examiner appointed to determine the grade.

7   Admission to the course

7.1   Admission requirements

To gain access to the course and complete the examinations included in the course, the applicant must be admitted to a doctoral programme at Örebro University.

Moreover, the applicant shall be admitted as a doctoral student within the subject area of Computer Science

7.2   Selection

Selection between applicants who have been admitted to doctoral programmes at Örebro University and who otherwise meet the admission requirements as listed above is made according to the following order of precedence:

If no other selection criteria are specified in this section, priority shall be given to applicants with a lower number of course credits left before the award of their degree over applicants with a higher number of remaining course credits. Should two or more students have equal number of credits, selection will be done through the drawing of lots. This also applies within any selection groups listed unless otherwise stated.

7.3   Other applicants than doctoral students admitted at Örebro University

Other applicants than doctoral students admitted at Örebro University may be given access to the course on the grounds of provisions for and/or agreements regarding contracted courses, joint degrees, national graduate schools or cooperation in other respects with other universities.

Any decisions on what such other applicants may be given access to the course are made separately and on the basis of the provisions and/or agreements that occasion the student to apply for the course.

For participation in the course in other respects, the same provisions shall apply as for doctoral students admitted to Örebro University.

8   Transfer of credits for courses, study programmes and other experience

Provisions on the transfer of credits can be found in the Higher Education Ordinance and on the university's webpage.

9   Other information

This course will be given in English

Transitional provisions

None.