Automatic Control
/Reglerteknik/

(SCB code 20202)

General description of the subject
The general description is a translation, as near as possible, of the Swedish version of the general description decided by the Board of the PhD Studies.

The fundamental problem in Automatic Control is to control a system using the feedback principle such that a desired behavior is achieved, despite disturbances acting on the system, limited a priori knowledge about the system and limitations of e.g. technical or economical character. The methods within the subject can, in addition to technical systems, be applied in a variety of fields such as e.g. economy and biological systems. The control field has connections to most engineering disciplines through its applications and also to subjects like production economy and biomedical engineering. The subject gives a general theoretical and methodological foundation concerning analysis of dynamical systems and is not connected to any particular application. The theoretical basis of the discipline has close connections to the fields Mathematics, Mathematical Statistics, Optimization, and Computer Science. The main research areas within the discipline are modelling and identification of dynamical system, signal processing with emphasis on sensor fusion, robotics and autonomous systems, and optimization for control applications in e.g. model predictive control.

Goals and objectives of the PhD studies
Common goals and objectives of the PhD studies are outlined in the introduction of the Faculty Study Handbook for PhD studies and in the Higher Education Ordinance (see Appendix A to the Faculty Study Handbook for PhD studies).

Degree
PhD studies in Automatic Control lead to a doctoral or licentiate degree. The latter can also be a stage in the PhD education. A Licentiate degree comprises a minimum of 120 ECTS credits including courses of at least 60 ECTS credits and dissertation work of at least 60 ECTS credits. A Doctoral degree comprises 240 ECTS credits including courses of at least 120 ECTS credits and thesis work of at least 120 ECTS credits.

Eligibility requirements and selection
The general eligibility requirements and the general selection regulations are specified in the Faculty Study Handbook for PhD studies.

Specific eligibility requirements
Eligibility for admission to PhD studies in Automatic Control has the one who fulfills the requirements for a degree at master level with a specialization relevant for the subject, or the one who has another degree on advanced level with relevant courses of corresponding depth and breadth.
Implementation of the PhD education

The PhD education in Automatic Control gives the PhD student the conditions to reach the learning objectives of the PhD degree. The PhD education encompasses research, PhD courses, participation in seminars, participation in national and international conferences, and interaction with industry.

The PhD education results in a broad knowledge and understanding in Automatic Control and related areas via PhD courses in the subject, courses from other departments, and participation in the teaching activities within the discipline on both Bachelor’s and Master’s level.

The PhD student acquires deep knowledge and understanding within Automatic Control in general and within his/her research topic in particular via participation in PhD courses, the independent work within the research project the student is involved in, participation in seminars and conferences, and collaboration with industry.

The PhD student develops his/her knowledge of scientific methodology via own research, which can include theoretical work, experiments, and applications in collaborations with industry. The PhD student also takes the mandatory course in scientific research methods and ethics.

The PhD students in Automatic Control acquire skills and abilities via:

- Independent planning and execution of theoretical and experimental research work.
- Presentation on a regular basis of achieved research results and future work for the colleagues within the research field.
- Participation in some of the main international conferences within the subject, e.g. IEEE Conference on Decision and Control or IFAC World Congress.
- Participation in the national community within the subject via e.g. contributions to the national conference Reglermöte.
- Presentation of own research results at national and international conferences, and active participation in these conferences, thereby developing skills in presenting results for researchers from various research fields, and in critically evaluating both own research and research results from others in the field.

The abilities to critically evaluate various aspects of research and a professional and responsible behavior as researcher are also developed via the mandatory course in scientific research methods and ethics and via interaction with others in academia as well as in industry.

Curriculum

All PhD students enrolled after July 1, 2007, have to complete one of the compulsory courses in research methods and ethics of 6 ECTS credits decreed by the faculty or to be deemed to have an equivalent qualification.

The detailed planning of courses and other elements in the studies are done in consultation with the supervisors and are documented in the individual study plan (see Faculty Study Handbook for PhD studies, Section 5.3).

The PhD courses within the subject include four fundamental courses that are given every second year, and the number of ECTS credits can vary depending on the execution of the course a specific year. The exact number of credits is decided by the supervisor. The fundamental courses are:
- Dynamical systems (9-12 ECTS)
- System identification (12 ECTS)
- Nonlinear control (9-12 ECTS)
- Robust multivariable control (12 ECTS)

In addition there is a set of courses that are given on a more irregular basis. Examples of such courses are:

- Linear estimation
- Adaptive filtering and fault detection
- Hybrid systems
- Adaptive control
- Optimal control
- Signal processing
- Algebraic methods in control
- Parametric optimization
- Modelling
- Applied control

The PhD students are encouraged to aim for a broad perspective by taking courses from other divisions and departments.

**Thesis**

The PhD students in Automatic Control show their intellectual independence by authoring a monograph or a compilation thesis.