EJ2230 Control in Electrical Energy Conversion 6.0 credits

Reglering för elektrisk energiomvandling

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

The official course syllabus is valid from the Spring semester 2024 in accordance with the decision by the Head of School: J-2023-2064.Date of decision: 2023-10-10

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

- Knowledge in electric machines and drive systems, 6 higher education credits, equivalent completed course EJ2201.

- Knowledge in power electronics, 6 higher education credits, equivalent completed course EJ2301.

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 should be able to:

- design and apply models for the electric energy conversion process, especially models for electrical machines and loads,
- apply the different time scales for the key variables in the electric energy conversion process,
- formulate closed-loop control systems with appropriate control methods and parameters that minimise electricity losses for different electrical machines,
- analyse stability and sensitivity of various control methods,
- apply the different principles of estimation of variables that cannot be measured directly and the importance of estimation with regard to the performance of the system

in order to be able to design and analyse control systems for electric energy conversion,

Course contents

- Summary of Laplace and Zeta transform, linear systems, three-phase systems, digital systems.
- Theory of Clarke- and Park transformations in n-phase systems.
- Electrical machine models, dynamics and operational regions without feedback.
- General principles of field-oriented control and flux weakening.
- Sensors for current -, speed and position feedback, inverter and their non-linearities.
- Estimate of magnetic flux linkage for control purpose.
- Tuning of controllers.
- Model-based sensorless algorithms.
- Sensorless algorithms with high-frequency voltage injection.
- Sensitivity analysis applied on vector control.
- Reference values for loss minimisation or improvement of performance.
- Direct torque control and predictive control applied to drive systems.

Examination

- PROA - Project assignment, 3.0 credits, grading scale: A, B, C, D, E, FX, F
- PROB - Project assignment, 3.0 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.

Transitional regulations

The earlier examining items were PRO1 (2 higher education credits) and TEN1 (4 higher education credits).

Students who passed TEN1 but not PRO1 can contact the examiner to obtain a new project task that replaced PRO1. Students who did not pass any of the above should make the re-examination.

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.