EL2620 Olinjär reglering 7,5 hp

Nonlinear Control

Fastställande

Kursplan för EL2620 gäller från och med HT10

Betygsskala

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

Utbildningsnivå

Avancerad nivå

Huvudområden

Elektroteknik

Särskild behörighet

For single course students: 120 credits and documented proficiency in English B or equivalent.

Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

Lärandemål

After finished course, the students will have knowledge in analysis of nonlinear dynamical systems using tools from control theory, such as linearization, Lyapunov methods, and

describing functions. They will be able to use computer-based tools for modeling, simulation and control design of nonlinear systems. They will have knowledge about advanced nonlinear control design methods. The theory is illustrated by many examples from mechanical, electrical, chemical and aeronautical engineering, as well as from bioengineering and finance.

In particular, the students should be able to:

- Solve problems using classical methods for analysis of nonlinear dynamical systems, such as linearization and phase-plane analysis, equilibria and oscillations.
- Use Simulink for modeling and simulation of nonlinear systems.
- In depth knowledge on how to solve stability problems using Lyapunov and LaSalle methods.
- In depth knowledge about input-output stability using the circle criterion and describing function analysis. The students should be able to apply this theory to compensation for saturation (anti-windup), friction, back-lash and quantization.
- Basic knowledge about passivity theory.
- Be able to solve simpler control design problems using high-gain design methods, such as linearization by high gain and sliding modes.
- Be able to solve simpler control design problems using Lyapunov design methods and feedback linearization.
- Determine controllability for nonlinear systems.
- Have basic knowledge about optimal control theory, and how to solve standard optimal control problems.

Kursinnehåll

Lecture 1-2: Nonlinear models, computer simulation; Lecture 3-6:Feedback analysis: linearization, stability theory, describing function; Lecture 7-10; Control design: compensation, high-gain design, Lyapunov methods; Lecture 11-13: Alternative methods: gain scheduling, optimal control, neural networks, fuzzy control.

Kurslitteratur

Lecture notes and exercises sold by the department. An highly recommended textbook is Khalil, H. K., Nonlinear Systems (3rd ed., 2002, Prentice Hall, ISBN 0-13-067389-7).

Examination

- TEN1 - Tentamen, 6,0 hp, betygsskala: A, B, C, D, E, FX, F
- LAB3 - Laboration, 0,5 hp, betygsskala: P, F
- LAB2 - Laboration, 0,5 hp, betygsskala: P, F
- LAB1 - Laboration, 0,5 hp, betygsskala: P, F

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

Övriga krav för slutbetyg

TEN 5.5 hp, LAB1 1 hp, LAB2 1 hp

Etiskt förhållningssätt

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.