EL2520 Control Theory and Practice, Advanced
Course 7.5 credits

Reglerteknik, fortsättningskurs

Course syllabus for EL2520 valid from Autumn 07, edition 1.

Intended learning outcomes

This course introduces basic theories and methodologies required for analyzing and designing advanced control systems. After the course, you should be able to

- Understand basic properties of multivariable linear systems, such as multivariable poles, zeros, system gains and associated critical input and output directions.
- Compute signal norms and system gains, and analyze closed-loop stability using the small gain theorem.
- Perform a thorough analysis of a closed-loop control system in terms of the critical transfer functions, including the sensitivity and complementary sensitivity function.
- Quantify fundamental limitations on control system performance due to time-delays, right-half plane zeros and poles and understand their implications on controller design.
- Derive frequency-dependent description of model uncertainty using the multiplicative uncertainty model and analyze robust stability and performance.
- Use the relative gain array to analyze interactions and propose decentralized control structures.
- Derive LQG-optimal controllers for scalar systems, and understand how the design parameters influence the closed-loop system properties.
- Understand how mixed H_inf control can be formulated in terms of an extended system, and propose reasonable performance weights.
- Develop anti-windup control strategies to deal with control signal limitations
- Understand the basic principles behind model-predictive control, including how the design parameters influence the closed-loop performance and how the basic problem can be transformed into an associated optimization problem.

Course main content

Mathematical descriptions of linear multivariable systems, design of multivariable controllers, fundamental limitations on achievable performance, robustness to model uncertainties, design of multivariable controllers, linear quadratic control, H2- och H8-optimal control, model predictive control.

Eligibility

Literature

Torkel Glad and Lennart Ljung, Control Theory - Multivariable and Nonlinear Methods, Taylor and Francis Ltd, ISBN 0748408789

Examination

- LAB1 - Laboratory Work, 1.5 credits, grade scale: P, F
• LAB2 - Laboratory Work, 1.5 credits, grade scale: P, F
• TEN1 - Examination, 4.5 credits, grade scale: A, B, C, D, E, FX, F

Requirements for final grade
Godkänd kurs fordrar tre stycken godkända datorlaborationer, ett godkänt laborationsprojekt, samt godkänd skriftlig tentamen.