Linear Systems

Introduction

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What is the course about?

- Introduction to applied linear systems.
- Introduction to linear systems
- Focus on state space representation and analysis, state feedback control and state estimation.

What to expect from the course?

- Important concepts in applied linear algebra
- State space representation and analysis of physical systems
- Design and analysis of state feedback controllers
- Design and analysis of linear state observers

Course Scoring and Grading

Course Activities

- Homework assignment 15%
- Surprize Quiz 25%
- Mid-term 15%
- Final 45%

Grading policy: **No relative grading**

- A+: Score $\geq 90/100$
- A: $80 \leq$ Score < 90
- B: $70 \leq$ Score < 80
- C: $60 \leq$ Score < 70
- D: $50 \leq$ Score < 60
- E: $40 \leq$ Score < 50
- F: Score < 40

Course content

Applied Linear Alegbra

- Vectors
- Matrices
- Least squares methods
- Eigenvectors and eigenvalues
- Matrix norm, Positive definiteness
- Singular Value Decomposition

State Space Representation and Analysis

- Linear dynamical systems (LDS)
- Modelling physical systems
- Solution to LDS
- Stability
- Controllability
- Observability

Controller and Observer Design

- State feedback control
- Linear observers
- *Linear quadratic regulators*
- *Kalman Filter*