

# Linear Systems Theory FRT001F 9p

## Description

Mathematical theory for linear dynamical systems.

## Topics covered

- Linear time-varying (LTV) systems.
- Linearisation.
- Coordinate transformation.
- Linear time-periodic (LTP) systems.
- Floquet-decomposition.
- Controllability and observability.
- Gramians.
- Controllable and observable form.
- Minimal realisation.
- Internal and Lyapunov stability.
- Input-output stability.
- Poles and zeros of MIMO systems.
- Smith-McMillan form.
- Polynomial fraction description.
- Adjoint systems
- Least squares

## Main reference

W. J. Rugh, *Linear System Theory 2nd ed.*. Prentice Hall, 1996, ISBN 0-13-441205-2.

## Additional references

- J. P. Hespanha, *Linear Systems Theory*. Princeton University Press. 2009. ISBN 9780691140216.
- D. Luenberger *Optimization by Vector Space Methods*. Wiley. 1998. ISBN 978-0-471-18117-0.

## Assessment

- 8 hand-ins (best of 7). (35%)
- Take-home exam (24 hours) (60%).
- Participation in exercise sessions - present solutions to at least 5 questions in total during the course (5%).

## Class schedule

- Week 42: Lecture 0+1 (Monday); Exercise 0 (Wednesday).
- Week 43: Exercise 1 (Monday); Lecture 2 (Wednesday).
- Week 44: Exercise 2 (Monday); Lecture 3 (Wednesday).
- Week 45: Exercise 3 (Monday); Lecture 4 (Wednesday).
- Week 46: Exercise 4 (tbd); Lecture 5 (Wednesday).
- Week 47: Exercise 5 (Monday); Lecture 6 (Wednesday).
- Week 48: Exercise 6 (Monday); Lecture 7 (Wednesday).
- Week 49: Exercise 7 (Monday); Lecture 8 (Wednesday).