Syllabus, Fall 2016

EE 585: Linear System Theory

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University of Southern California

Lecture Information

Lectures: TuTh 9:30–10:50, VHE 217

Contacts

Professor Insoon Yang
EEB 316
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Office hours: Tue 11:00–12:00, Wed 5:00–6:00

Prerequisites

Linear Algebra (EE 441 or equivalent)

Evaluation

There will be 8 problem sets, a midterm test, and a final exam.
Course grades: Problem sets (40%); Midterm (20%, Oct. 11); Final (40%)

Policies

Working in groups is encouraged. However, each person must submit his/her own problem sets. Problem sets are due by 5PM in a box in front of Prof. Yang's office, EEB 316. Late submissions will not be accepted.

Course References

The course is based on a set of lecture notes. The following textbook is optional:

- J. P. Hespanaha, *Linear System Theory*, Princeton University Press, 2009.

Other useful references are as follows:

- F. Callier, C. A. Desoer, *Linear System Theory*, Springer-Verlag, 1991.
- Stephen Boyd's lecture slides: `http://stanford.edu/class/ee363/lectures.html`.
- C.-T. Chen, *Linear System Theory and Design*, Oxford, 2012.
- W. J. Rugh, T. Kailath, *Linear System Theory*, Prentice-Hall, 1980.
- R. W. Brockett, *Finite Dimensional Linear Systems*, SIAM, 2015.
- P. J. Antsaklis, A. N. Michel, *Linear Systems*, Birkhäuser, 2005.

Course Outline

- *Linear Algebra* (8/22–9/2): fields, vector spaces, subspace, linear operators, range and null spaces, norms, inner-products.
- *Matrix Theory* (9/5–9/16): eigenspaces, Jordan form, Hermitian forms, eigen decomposition, positive definite matrices, singular value decomposition, Gram-Schmidt orthonormalization, least squares-optimization.
- *Differential Equations* (9/19–9/23): existence and uniqueness, Lipschitz and uniform continuity.
- *Linear Dynamical Systems* (9/26–10/7): the notion of state, input and output, state transition matrix, matrix exponential, Cayley-Hamilton theorem, invariant subspaces.
- *Stability* (10/12–10/21): internal stability, input-output stability, Lyapunov theory.
- *Controllability and Observability* (10/24–11/11): definitions, computational aspects, canonical forms, Kalman decomposition, minimal realizations.
- *Feedback Control Systems* (11/14–11/18): pole placement, stabilizability and detectability, observers, state estimation, the separation principle.
- *Linear Quadratic Optimal Control* (11/21–12/2): Riccati equations, convexity, connections to Pontryagin maximum principle and dynamic programming.

Statement on Academic Conduct and Support Systems

- Academic Conduct

  Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards (`https://policy.usc.edu/student/scampus/`). Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct (`http://policy.usc.edu/scientific-misconduct/`).

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- Support Systems

  A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute (`http://dornsife.usc.edu/ali`), which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs (`http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html`) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information (`http://emergency.usc.edu/`) will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.