EE601 - Linear System Theory and Design - Fall 2016

Instructor
Dr. Sridhar Seshagiri (seshagir@engineering.sdsu.edu) (E403G)
Off hrs: TWT 2-3:15pm (or by appointment)

Catalog Description
Introduction to applied linear algebra and linear dynamical systems, with applications to circuits, signal processing, communications, power and control systems.

Prerequisites by topic
Some familiarity with linear algebra, as well as ordinary differential equations, is strongly recommended, although the necessary material will be reviewed in the context of the course.

Reference texts
- Introduction to Linear Algebra, G. Strang.
- Introduction to Dynamic Systems, Luenberger, Wiley.
- A Linear Systems Primer, Panos J. Antsaklis & Anthony N. Michel, Birkhauser 2006

Grading
1. Quizzes - 10% (in class) + 10% (matlab take-home) = 20%
2. 2 Midterms - 2*25 = 50 %
3. Final Exam - 30 %

Tentative Course Outline
1. Vector spaces & Matrix theory – Linear Spaces and linear operators, bases, subspaces, dimension, inner products and orthogonality, vector norms, matrix norms, Gram-Schmidt procedure, QR decomposition, least squares problems and applications, quadratic forms and positive definite matrices, symmetric matrices, row/column/null spaces, rank and nullity, eigenvalues and eigenvectors, coordinate transformations, Jordan forms, singular value decomposition (SVD) and applications.

2. Examples/properties of linear dynamic systems described by ODEs and difference equations, time varying linear systems, time domain solutions. Time/shift invariant systems treated as a special case, properties of matrix exponentials. Nonlinear systems and linearization
3. Multi-input multi-output systems, transfer functions and impulse response; convolution and convolution-like (LTV) integrals.

4. System-theoretic concepts: causality, stability (internal and input-output), passivity, feedback, controllability and state-transfer (incl. eigenvalue assignment), observability and least-squares estimation (optimality), realizations, Kalman canonical decomposition.


Course objectives

1. Brief introduction to the theory and applications of linear algebra and matrix theory.

2. Introduction to linear system theory, state-space and input-output models, both continuous as well as discrete time.

3. Understand and characterize qualitative properties of systems, including stability, passivity, controllability and observability.


Academic Misconduct

I plan on following the University rules on academic misconduct. Specifically, collaboration is not permitted in the quizzes/exams, nor looking into someone else’s work. Instances of academic misconduct will

(i) result in a failing grade in the course and

(ii) will be reported to the Office of Judicial Procedures.

Please note that your colleagues are watching you and have as much interest in a fair grading environment as I do. In the past, I have had students report offending activities, and follow up action has resulted in suspension.

Note :

(1) Students who need accommodation of their disabilities should contact me privately to discuss specific accommodations for which they have received authorization. If you have a disability, but have not contacted Disabled Student Services, please do so at 619-594-6473 (SS-1661) before making an appointment to see me.

(2) The University Policy File includes the following statement on Absence for Religious Observances: “By the end of the second week of classes, students should notify the instructors of affected courses of planned absences for religious observances”. Moreover, California Education Code 89320 states: “The Trustees of the California State University shall require that each state university, in administering any test or examination, to permit any student who is eligible to undergo the test or examination to do so, without penalty, at a time when that activity would not violate the student’s religious creed. In keeping with the above, I will make every reasonable attempt to accommodate any requests for rescheduling midterms/exams as long as I have been notified sufficiently in advance. The only other valid grounds for a makeup will be medical reasons, as longs as they are substantiated by a physician.

http://engineering.sdsu.edu/~seshagir