Electrical Engineering Department
University of Maryland, College Park

ENEE769C Advanced Topics in Controls: Analysis and Design of Remote Feedback Systems

Fall 2006

Lectures: MW 11:00AM-12:15PM (EGR 3106)
Office Hours: MW 2:00PM-4:00PM; Room 2259 A.V. Williams

Instructor: Professor Nuno C. Martins
Room 2259 A.V. Williams Bldg.
Electrical Engineering Department
and Institute for Systems Research
Tel: 301-405-9198
E-mail: nmartins@isr.umd.edu

References: Course slides, articles and personal notes on some of the covered material

Topical outline:

1. Motivation and review of linear system theory.
2. Basic notions of stability, for linear and time-invariant systems, based on stochastic measures. Stochastic interpretation to Lyapunov's equation.
3. Basics of optimal control for linear and time-invariant systems. State feedback and the discrete-time and continuous-time Riccati equations.
4. Introduction to linear matrix inequalities (LMI). Schur complement.
5. Casting standard Lyapunov and Riccati equations as LMI's. Other examples of optimization problems that can be cast as LMIs.
6. Brief overview of output feedback optimal control: The H_2 and H_∞ optimal control problems.
7. Casting the H_2 and H_∞ optimal control problems as LMI's. Relationship with passivity.
8. Motivation and introduction to Markovian jump linear systems (MJLS). Modeling a networked control system over a packet-drop network as a MJLS.
9. Necessary and sufficient conditions for the stochastic stability of MJLS. Coupled Lyapunov equations in discrete and in continuous time.
10. Casting coupled Lyapunov equations as LMI's.
11. State feedback of MJLS and the separation principle for output stabilization. Optimal state feedback: coupled Riccati equations.
12. Casting coupled Riccati equations for the optimal state feedback stabilization of MJLS as an LMI.
13. Extensions and recent results for the optimal output feedback of MJLS.

The course evaluation consists of a project, which can be tackled individually or in group. The timeline and topic of the project is determined in agreement between the instructor and each student or group.