

AEM8421/EE5235: Robust Multivariable Control Systems

Instructor:

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Course Information:

Textbook (Recommended): Skogestad and Postlethwaite, Multivariable Feedback Control, Wiley, 2nd Edition, 2005
Webpage: <https://www.aem.umn.edu/courses/aem8421/spring2014/>
UNITE (with access to lecture videos): <https://www.unite.umn.edu/>
University Policy Statements: <http://www.aem.umn.edu/teaching/syllabi.shtml>
Prerequisites: AEM5321, EE5231, or instructor consent

Catalog Descriptions:

AEM 8421: Application of robust control theory to aerospace systems. Role of model uncertainty/modeling errors in design process. Control analysis and synthesis, including H_2 and H_∞ optimal control design and structural singular value μ techniques.

EE5235: Development of control system design ideas; frequency response techniques in design of single-input/single-output (and MIMO) systems. Robust control concepts. CAD tools.

Homework:

Homeworks will be assigned approximately once every two weeks. They will typically be due on Wednesday at the beginning of class. A 50% penalty will be assessed for late homeworks.

Exams:

There will be one midterm exam scheduled for March 12, 2013. There is no final exam. Instead, a final project will be due during finals week. The project will emphasize the application of the multivariable control analysis and synthesis techniques to a real work control problem.

Scholastic Dishonesty:

Cheating, whether it is on your problem sets or exams, is absolutely unacceptable. Please refer to the Student Conduct Code at:

http://www1.umn.edu/regents/policies/academic/Student_Conduct_Code.pdf

Grading:

Letter grades for the course will be assigned using the following scale:

A	90.0 - 100
B	80.0 - 89.9
C	70.0 - 79.9
D	60.0 - 69.9
F	below 60.0

This scale may be adjusted depending on the performance of the class. Any adjustments to the scale will only lower the cut-offs to achieve a specified grade; cut-offs will not be raised beyond those listed here. Grades will be weighted as follows: Homeworks 30%, Midterm 35%, and Final Project 35%. Students can check their posted grades at: <http://www.aem.umn.edu/srs>

Course Outline:

- Classical control review
- SISO frequency domain performance, robust stability, and robust performance
- SISO control design tradeoffs, limits of performance of feedback systems, and Bode integral theorem.
- Linear algebra review, norms of signals, induced norms of systems.
- Stabilization of multivariable feedback control systems.
- Linear fractional transformations (LFT), modeling uncertain systems using LFTs, structured singular value (μ), S-procedure.
- Assessing robust stability and worst-case performance for uncertain systems.
- H_∞ control design: Lyapunov and Riccati equations, Riccati inequalities, linear matrix inequalities.
- μ -synthesis control design

Disclosure Statement:

Prof. Peter Seiler is a consultant for MUSYN, a company that produces some of the design and analysis software for automatic control systems taught in this class.