ECE 5194.11 (Proposed): Group Studies in Robust Control with Applications to Time Delay Systems

Course Description

Prior Course Number: 694
Transcript Abbreviation: Robust Control
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Senior, Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Even Years
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: ECE 3551 or AERO 3521 or MAE3360 or Grad Standing.
Exclusions:
Cross-Listings:

Course Rationale: Pilot a new course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CpE</td>
<td>Computer Engineering</td>
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<tr>
<td>EE</td>
<td>Electrical Engineering</td>
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Course Goals

Students will be able to compute stability robustness margins for time delay systems.

Students will be able to obtain a parameterization of the set of all stabilizing feedback controllers for a given plant and design strongly stabilizing (stable) controllers.
Students will be able to design robustly stabilizing controllers for a given plant and dynamic uncertainty weight, by solving a model matching problem.

Students will be able to solve two-block H-infinity control problem.

**Course Topics**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Lec</th>
<th>Rec</th>
<th>Lab</th>
<th>Cli</th>
<th>IS</th>
<th>Sem</th>
<th>FE</th>
<th>Wor</th>
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<tbody>
<tr>
<td>Review of basic feedback control system analysis and design, Nyquist stability test.</td>
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<td>Stability margins for time delay systems. Norms for signals and systems.</td>
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<td>Modeling, uncertainty and robustness.</td>
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<tr>
<td>Robust stability tests under parametric uncertainty.</td>
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<td>Robust stability and robust performance. Mixed sensitivity minimization.</td>
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<td>Stabilization. Parametrization of stabilizing controllers.</td>
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<td>Model matching problem: finite dimensional case.</td>
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<td>Mixed sensitivity minimization problem: spectral factorization and reduction to one block.</td>
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<td>Small gain theorem; performance limitations, delay margin optimization.</td>
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<td>Strong stabilization problems for time delay systems</td>
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<td>Robust control applications involving systems with time delays: modeling.</td>
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<td>Robust control applications: distributed parameter systems.</td>
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**Representative Assignments**

Homework
Midterm
Final Exam

**Grades**

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<tr>
<th>Aspect</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
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<tr>
<td>Midterm 1</td>
<td>25%</td>
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<tr>
<td>Midterm 2</td>
<td>25%</td>
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<tr>
<td>Final Exam</td>
<td>30%</td>
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**ABET-EAC Criterion 3 Outcomes**

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<thead>
<tr>
<th>Course Contribution</th>
<th>College Outcome</th>
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<tr>
<td>***</td>
<td>A. An ability to apply knowledge of mathematics, science, and engineering.</td>
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<td>B. An ability to design and conduct experiments, as well as to analyze and interpret data.</td>
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<td>C. An ability to design a system, component, or process to meet desired needs.</td>
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<tr>
<td>Course Contribution</td>
<td>College Outcome</td>
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<td>d</td>
<td>An ability to function on multi-disciplinary teams.</td>
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<td>An ability to identify, formulate, and solve engineering problems.</td>
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<td>An understanding of professional and ethical responsibility.</td>
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<td>g</td>
<td>An ability to communicate effectively.</td>
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<td>The broad education necessary to understand the impact of engineering solutions in a global and societal context.</td>
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<tr>
<td>i</td>
<td>A recognition of the need for, and an ability to engage in life-long learning.</td>
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<td>j</td>
<td>A knowledge of contemporary issues.</td>
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<tr>
<td>**</td>
<td>An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.</td>
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**Additional Notes or Comments**

Entered 9/13 by BLA for Hitay Ozbay

**Prepared by:** Betty Lise Anderson