

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

## Course Description

Review of time and frequency domain analysis and design of feedback systems. Internal stability, asymptotic tracking, performance. Robust stability and robust performance. strong Stabilization. Parametrization of stabilizing controllers. Delay margin. Model matching. Introduction to H-infinity control.

**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

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

## 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

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Review of basic feedback control system analysis and design, Nyquist stability test.	3.0							
Stability margins for time delay systems. Norms for signals and systems.	3.0							
Modeling, uncertainty and robustness.	3.0							
Robust stability tests under parametric uncertainty.	3.0							
Robust stability and robust performance. Mixed sensitivity minimization.	3.0							
Stabilization. Parametrization of stabilizing controllers.	3.0							
Model matching problem: finite dimensional case.	3.0							
Model matching problem: infinite dimensional case.	3.0							
Mixed sensitivity minimization problem: spectral factorization and reduction to one block.	3.0							
Small gain theorem; performance limitations, delay margin optimization.	3.0							
Strong stabilization problems for time delay systems	3.0							
Robust control applications involving systems with time delays: modeling.	3.0							
Robust control applications involving systems with time delays: controller design.	3.0							
Robust control applications: distributed parameter systems.	3.0							

## Representative Assignments

Homework
Midterm
Final Exam

## Grades

Aspect	Percent
Homework	20%
Midterm 1	25%
Midterm 2	25%
Final Exam	30%

## ABET-EAC Criterion 3 Outcomes

Course Contribution	College Outcome
***	a An ability to apply knowledge of mathematics, science, and engineering.
	b An ability to design and conduct experiments, as well as to analyze and interpret data.
	c An ability to design a system, component, or process to meet desired needs.

<b>Course Contribution</b>		<b>College Outcome</b>
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

### **Additional Notes or Comments**

Entered 9/13 by BLA for Hitay Ozbay

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