ECSE-6400: Systems Analysis Techniques
FALL 2010

Instructor: Dr. Agung Julius (JEC 6044, Email: agung@ecse.rpi.edu, Phone: x6993)
Office hours: Tuesday, Wednesday; 14.00 – 15.00
Teaching Assistant: Xiaoqing Ge (gex@rpi.edu)
Office hours: Wednesdays 11am-12pm, CII 8117

Classroom: JEC 4107/ Monday,Thursday; 16:00 – 17:20
Textbook: DeRusso et al, State Variables for Engineers 2ed, Wiley Interscience, 1998.

Grading:	Homework (6 sets)	35%
	Midterm Exam 1+2	15% + 20%
	Final exam	30%

- Homework sets are due one week after hand-out at the end of the class. For each day late (**3 days max**), there is a 10pt penalty.
- There will be two (2) midterm exams in class.
- Final exam will be given at a scheduled date.

Prerequisites: ECSE 2410 (Signal and Systems) or equivalent. Familiarity with MATLAB.

Summary:
This course trains the students in the state-space theory for linear systems. Various related concepts, such as state-space model derivation, controllability & observability, and controller design for pole placement are covered. In addition to that, the course will review linear algebra and matrix theoretic concepts that are relevant to the state-space theory, with their applications. Linear quadratic functions are also discussed in relation to Lyapunov stability theory and linear quadratic optimization in optimal estimation and Kalman filtering. In this course, some computation tasks will be done with MATLAB.

Learning Objectives:
The students are expected to:

- understand the concept of state variables and how to derive them from different linear system representations.
- know how to solve a system of linear differential equations in state space form.
- understand the geometric aspect of linear state-space, including the concepts of eigenvalues decomposition and singular value decomposition.
- understand the concepts of controllability and observability in linear systems,
- be able to perform controller design for stabilization and pole placement for linear systems,
- understand the principles behind least squares estimation and discrete-time Kalman filtering.

Statement of academic integrity:
The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty and the students should make themselves familiar with these. All homework, quizzes and exam are expected to be individual work. You are allowed to work together for the homework. However, the writing must be your own (copying is not acceptable). One instance of unacceptable collaboration or plagiarism will result in 0 point for the work. A second instance of academic dishonesty will result in failure of the course.

Tentative Course Outline:

Date	Day	Topic	Remark
8/30	Mon	Intro, course structure, course overview, Sect. 1.1, 1.2, 1.4, 1.5.	
9/2	Thu	Sect 2.1 – 2.4	
9/9	Thu	Sect 3.1 – 3.2	HW 1
9/13	Mon	Sect 3.3 – 3.4	
9/16	Thu	Sect 2.5	HW 1 due
9/20	Mon	Sect 3.5 – 3.7	
9/23	Thu	Sect 3.8	HW 2
9/27	Mon	Sect 3.9	
9/30	Thu	Sect 3.10	HW 2 due
10/4	Mon	Sect 3.11 – 3.12	
10/7	Thu	Sect 4.4, Sect 5.1-5.4	
10/12	Tue	**EXAM 1 in class**	
10/14	Thu	Sect 5.5, 5.9, 5.11	HW 3
10/18	Mon	Sect 5.6-5.7	
10/21	Thu	Sect 4.1 – 4.3, Sect 6.1 – 6.2	HW 3 due
10/25	Mon	Sect 7.1 – 7.4	
10/28	Thu	Sect 7.5 – 7.7	HW 4
11/1	Mon	Sect 7.8 – 7.10	
11/4	Thu	Sect 6.3 – 6.5	HW 4 due

11/8	Mon	Sect 6.6 – 6.7	
11/11	Thu	Sect 6.8	HW 5
11/15	Mon	Sect 9.1 – 9.3, 9.6	
11/18	Thu	**EXAM 2 in class**	
11/22	Mon	Sect 9.7-9.9, 9.15, 9.17	HW 5 due
11/29	Mon	Sect 8.1 – 8.4	
12/2	Thu	Sect 8.5 – 8.7	HW 6
12/6	Mon	Sect 8.8	
12/9	Thu	Review	HW 6 due
XXXXX	XXXX	Final Exam	