ECSE 6460: Multivariable Control Systems

Fall 2009

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	RPI LMS
Grading:	Homework sets (5-6 sets) = 40%
	2x Exams (take home) = 2 x 30%

Textbook: S. Skogestad and Ian Postlethwaite, *Multivariable Feedback Control* 2ed, Wiley, 2005.

Summary:

This course is centered on modern multivariable control system design. Most of the discussion is focused on linear time invariant systems, both in the time-domain and frequency-domain. Topics that will be covered in this course include: classical feedback control, loop-shaping, introduction to multivariable control, limitations on performance in control systems, disturbance and robustness issues, controller design, and model reduction.

Learning Objectives:

The students are expected to understand the key aspects of robust multivariable control system design, including system properties in time- and frequency-domain, formulation of the control problems, notions of system performance, and controller design. Proficiency evaluation will be conducted through home work sets and take home exam sets, which will include some control design tasks. Some computation tasks will be done with MATLAB.

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. In this class, all assignments that are turned in for a grade must represent the student's own work. The students are allowed to collaborate and exchange ideas in solving the homework sets. However, copying is not acceptable. Further, no collaboration is allowed for the exams.

Tentative Course Outline:

Nr.	Subject	Remark
1	(**Tue 1 Sept**) Introduction: course policies, grading, schedule, overview.	
2	(**Fri 4 Sept**) Chapter 2: Classical Feedback Control, Frequency response and transfer function, Bode plot (linear approximation), Feedback control, closed loop stability (2.1 – 2.3)	
3	(**Tue 8 Sept**) Chapter 2: Classical Feedback Control Closed loop performance, controller design, loop shaping (2.4 - 2.6)	**HW1 hand out**
4	(**Fri 11 Sept**) Chapter 2: Classical Feedback Control Loop shaping, sensitivity (2.7 - 2.8)	
5	(**Tue 15 Sept**) Chapter 3: Transfer functions, frequency response, relative gain array (3.1 -3.4)	**HW1 hand in**
6	(**Fri 18 Sept**) Chapter 3: Subjects from Chapter 4, Control of multivariable plants, RHP zeros and multivariable robustness (3.5-3.7)	
7	(**Tue 22 Sept**) Chapter 3: Multivariable robustness and general control formulation (3.7-3.8)	**HW2 hand out**
8	(**Fri 25 Sept**) Chapter 5&6: Performance limitations (5.1 – 5.3, 6.1 – 6.3)	
9	(**Tue 29 Sept**) Chapter 5&6: Performance limitations (5.4 – 5.9)	**HW2 hand in**
10	(**Fri 2 Oct**) Chapter 5&6: Performance limitations (6.4 – 6.7)	
11	(**Tue 6 Oct**) Chapter 5&6: Performance limitations (5.10 – 5.12)	**HW3 hand out**
12	(**Fri 9 Oct**) Chapter 5&6: Performance limitations (6.8 – 6.11)	
13	(**Fri 16 Oct**) Chapter 7: Uncertainty and robustness for SISO systems	**HW3 hand in**
14	(**Tue 20 Oct**) Chapter 7: Uncertainty and robustness for SISO systems	
15	(**Fri 23 Oct**) Chapter 8: (8.1 – 8.4)	
16	(**Tue 27 Oct**) Chapter 8: (8.5 -8.8)	**First Exam**
17	(**Fri 30 Oct**) Chapter 8: (8.9 – 8.11)	**Exam hand in**
18	(**Tue 3 Nov**) Chapter 8: (8.12 – 8.13)	
19	(**Fri 6 Nov**) Chapter 9&10: Controller design	
20	(**Tue 10 Nov**) Chapter 9&10: Controller design	
21	(**Fri 13 Nov**) Chapter 9&10: Controller design	**HW4 hand out**
22	(**Tue 17 Nov**) Chapter 9&10: Controller design	
23	(**Fri 20 Nov**) Chapter 9&10: Controller design	**HW4 hand in**
24	(**Tue 24 Nov**) Chapter 9&10: Controller design	
25	(**Tue 1 Dec**) Chapter 9&10: Controller design	**HW5 hand out**
26	(**Fri 4 Dec**) Chapter 9&10: Controller design	
27	(**Tue 8 Dec**) Chapter 11: Model reduction	**HW5 hand in**
28	(**Fri 11 Dec**) Chapter 11: Model reduction	**Second Exam**