Linear and Robust Control Systems ELEC 9731

Session I 2016

Instructor:	Prof Victor Solo	
E-Mail:	v.solo@unsw.edu.au	[use subject: ELEC 9731]
UOC:	6	
Class Times:	Wednesday, 6pm-9pm	Room: Quad G046
Prerequisites:	Undergraduate Control Course	
Office Hours:	Monday, 4pm-5pm	Room TBA

Course Organisation

There are two parts to the course
Part I: Linear Systems and Control: weeks 1-6
Part II: Robust Control: weeks 7 -12

Aims:

Provide an introduction to multivariable linear system theory and control from both an input/output and a state space point of view.
Provide an introduction to Robust Control and some aspects of System Identification.

Assessment :

To pass, students must obtain a pass level in each part of the course

Assignments (two for each part)		10% each
Exams (one for each part)	(Take-home)	30% each

Assignments should have a School Assignment Sheet as the first page.
These sheets are available from the School Office,
or may be downloaded from the School web page.
Keep a copy of your assignment
Late assignments will be penalised at 10% of the maximum value per day late.

Exam The same arrangements apply as for Assignments.

Assignment, Exam Timetable

Assignment **1**: out - week 2 ; due - week 4
Assignment **2**: out - week 4 ; due - week 6
Exam: out - week 6 ; due - week 8
Assignment **3**: out - week 8 ; due - week 10
Assignment **4**: out - week 10 ; due - week 12
Exam: out - week 12 ; due - week 14

Resources
Part I

Software: Matlab (including Simulink)
Textbook: none.
References: in Library Open Reserve
i T. Kailath (1980). Linear Systems. Prentice Hall. P003/202
ii GC Goodwin, SF Graebe, ME Salgado (2000),
Control System Design. Prentice Hall. P629.8/203

Part II

Software: Matlab (including Simulink)
Textbook: none
i G.C. Goodwin, S.F. Graebe and M.E. Salgado (2000)
Control Systems Design. Prentice Hall.
ii L. Ljung. (1999), System Identification: Theory for the User
2nd., ed., Prentice-Hall, HUC 003/164 D
iii J. Doyle, B. Francis, A. Tannenbaum, (1990),
Feedback Control Theory, Macmillan Press (the book is available on the web)

Teaching Strategies

Lectures	to give the basic material in written form, and to highlight the importance of different sections, and help with the formation of schema.
Assignments	to give practice in problem solving, and to assess your progress.
Examination	the final test of competency.

Learning Outcomes

At the end of the course the student will be familiar with basic aspects of linear system theory and control, from both an input/output and a state space point of view The student will be able to use this knowledge to solve basic problems in linear system theory, control design and system identifiication.

Academic Honesty and Plagiarism

Plagiarism means copying. You cannot copy other peoples work of any kind; you cannot copy from any source. Plagiarism is a serious offence and (severe) penalties will apply; see https://student.unsw.edu.au/plagiarism

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational heath and safety, enrolment, rights, and general expectations of students, please refer to the School policies, on the School webpage.

Week	Topic
	Matrix Review Handout. Including: eigenvector decomposition; singular value decomposition; matrix inversion lemma.
1a	Review SISO State Space Including: modal transformation; controllability ; observability; state space decomposition theorem; polynomial division; Sylvester resultant and coprimeness.
2	Feedback Linear state feedback; Bass-Gura formula; modal approach; internal model principle. Linear state feedback with observer; limits to control; right half plane zeroes.
3a	tracking and disturbance rejection.
3b	MIMO systems Gilbert's form; matrix fraction description; state space; controllability, observability.
4	Polynomial Matrices unimodular matrices; Smith form; Smith-McMillan form. MIMO poles and zeroes.
5	MIMO decomposition theorem. Hankel Methods.
6	Balanced realization. MIMO Linear state feedback with observer.
7	Introduction to System Identification. FIR modeling.
8	Noise Models in System Identification.
9	State Space Subspace Methods of System Identification.
10	Spectral Estimation and Closed Loop System Identification.
11	Introduction to Robust control.
12	Robust PID controllers.