Course Webpage https://subjects.ee.unsw.edu.au/elec9731/

Linear and Robust Control Systems ELEC 9731

Session I 2017

Instructors:

Part I	Prof Victor Solo	
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Part II	Prof Andrey Savkin	
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Course Organisation

Prerequisites:	Undergraduate Control Course	
UOC:	6	
Class Times:	Monday, 6pm-9pm	Room: OMB230

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

Aims:

Provide an introduction to linear system theory
and system identification
Provide an introduction to Robust Control
Optimal control, Optimal and Robust Filtering

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 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 - 16 days later

Resources

Part I

Software: Matlab (including Simulink)
Textbook: none.
References: in Library Open Reserve
1. T. Kailath (1980). Linear Systems. Prentice Hall. P003/202
2. L. Ljung (1999), Theory for the User
2nd.,edn., Prentice Hall. - HUC (003/164D)

Part II

Software: Matlab (including Simulink)
Textbook:
1. R.C. Dorf and R.H.Bishop. Modern Control Systems. Addison Wesley, 8th edition, 1998.
2. G.C. Goodwin, S.F. Graebe and M.E. Salgado (2000)
Control Systems Design. Prentice Hall.
3. J.B. Burl. Linear Optimal Control. Addison Wesley, 1999, pp. 329-364.
References
1. K. Zhou. Essentials of Robust Control. Prentice Hall, 1998.
2. M.S. Grewal and A.P. Andrews. Kalman Filtering. Prentice Hall, 1993.
3. I.R. Petersen and A.V. Savkin. Robust Kalman Filtering for Signals and Systems with Large Uncertainties. Burkhauser, Boston, 1999.
4. I.R. Petersen, V.A. Ugrinovskii and A.V. Savkin. Robust Control Design Using H-infinity Methods. Springer-Verlag, 2000.

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 ,
system identification.
The student will be able to use this knowledge to solve
basic problems in linear system theory and
system identification.

Academic Honesty and Plagiarism

Plagiarism means copying. You cannot copy other people's 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,
see http://www.engineering.unsw.edu.au/electrical-engineering/administrative-procedures

Week	Topic
1	Matrix Review Handout Including: eigenvector decomposition; singular value decomposition; matrix inversion lemma; projection lemma; generalised inverses.
2a	Review SISO State Space Including: transformation between transfer function and state space ; modal transformation; controllability ; observability.
2b	State space decomposition theorem; polynomial division; Sylvester resultant and coprimeness.
3	Introduction to System Identification. Including: Finite Impulse Response (FIR) Modeling.
4	Noise Models. Including: AR,ARMA, Spectrum. AR model fitting.
5	State Space Subspace (S^4) Methods. Including: Computational Aspects via SVD and QR algorithms.
6	Spectral Estimation & Estimation in Closed Loop. Including: Effect of filtering on spectra. Transfer Function estimation with cross-spectra.