ENGG*6580 Advanced Control Systems
Fall 2016

UNIVERSITY
of GUELPH
School of Engineering

1 INSTRUCTOR

Instructor: Simon Yang, Ph.D.
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Office hours: by appointment

2 LEARNING RESOURCES

2.1 Course Website
Course material, news and announcements will be regularly posted to the ENGG*6580 courslink.

2.2 Resources
No specific textbooks will be assigned. Follow lecture notes and use the following references:
2.3 Additional Resources

Additional resources will be posted at the course web site.

3 ASSESSMENT

3.1 Dates and Distribution

Assignments: 10%
Quizzes: 10%
Project: 60%
  ● Proposal: 10% (Monday, Oct. 10, in class)
  ● Interim Report: 10% (Monday, Nov. 7, in class)
  ● Final Presentation: 10% (Friday, Dec. 2, in class)
  ● Final Report: 30% (Friday, Dec. 2, in class)

Final Exam: 20%
  2:00-4:00 pm, Monday, Dec. 5.

3.2 Course Grading Policies

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course in writing, with your name, id#, and e-mail contact. See the graduate calendar for information on regulations and procedures for Academic Consideration:

http://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/sec_d0e1415.shtml

Accommodation of Religious Obligations:

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml
4 AIMS & OBJECTIVES

4.1 Calendar Description

This course will start with state space analysis of multi-input multi-output control systems. Then state space design will be presented. After that, nonlinear control systems and soft computing based intelligent control systems will be studied. Finally, hybrid control systems, H infinite control and uncertainty and robustness in control systems will be addressed.

4.2 Course Aims

This course is to present advanced control systems theories and their applications. The main goals of this course are: (1) students are aware of the advanced control systems approaches; and (2) students are able to apply these control systems approaches to specific applications.

4.3 Learning Objectives

Students who successfully complete this course will be able to:

- Have a good understanding of advanced control systems, including both linear and nonlinear systems, continuous and discrete systems;
- Be able to conduct theoretical analysis of the stability, performance and system properties of a given control system;
- Be able to develop a suitable controller for a specific control system with desired performance and guaranteed stability and convergence;
- Be able to apply the advanced modern control theory to control design and system analysis of an engineering system, with considerations of uncertainties and robustness.

4.4 Instructor’s Role and Responsibility to Students

The instructor’s role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture related materials will be made available to students on the course web site. During lectures, the instructor will explain the fundamental knowledge and applications. Scheduled classes will be the principal venue to provide information and feedback for tests and project.

4.5 Students’ Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who may fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.
E-mail Communication:
All students are required to check their University of Guelph e-mail account regularly. E-mail is the official route of communication between the University and its students.

Recording of Materials:
Presentations which are made in relation to course work—including lectures—cannot be recorded in any electronic media without the permission of the presenter, whether the instructor, a classmate or guest lecturer.

4.6 Relationships with other Courses

Previous Courses:
- ENGG*3410 Systems and Control Theory
- ENGG*4280 Digital Control Systems

5 Teaching and Learning Activities

5.1 Timetable
Lectures:
2:00-5:00 pm, Tuesday, RICHS 3527

5.2 Course Topics and Schedule
The tentative topics and schedule of this course are listed as the following:
- State space analysis of control systems: quick review of related mathematical background; state space model; transfer functions; transfer function matrix; state space response; eigenvalues, eigenvectors, and modes; stability; controllability, observability and stabilizability.
- State space design of control systems: state feedback and pole assignment; optimal control; state observer design; output feedback control.
- Digital control systems: Z transfer function; transient response of digital systems; stability; the Z-plane and root locus; design of digital controllers; state space method.
- Nonlinear control systems: nonlinearities; phase-plane method; describing function method; stability and limit cycles; Lyapunov and Popov methods.
- Uncertainty and robustness in control systems: model uncertainty; robust stability; robust performance.
5.3 Other Important Dates

Thursday, September 8: First day of class
Monday, October 10: Holiday, no class
Tuesday, October 11: Fall study break day, no class
Thursday, Dec. 1: Classes rescheduled for Tue. Oct. 11
Friday, December 2: Classes rescheduled for Mon. Oct. 10

6 Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University’s policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. The Academic Misconduct Policy is detailed in the Graduate Calendar:

https://www.uoguelph.ca/registrar/calendars/graduate/2014-2015/genreg/sec_d0e1780.shtml

7 Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community’s shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible

For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: http://www.uoguelph.ca/csd/
8 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9 RESOURCES

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:
http://www.uoguelph.ca/registrar/calendars/index.cfm?index

The Graduate Calendar is the source of information about the University of Guelph’s procedures, policies and regulations which apply to graduate programs:
http://www.uoguelph.ca/registrar/calendars/graduate/current/

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:
http://www.academicintegrity.uoguelph.ca/

The School of Engineering has adopted a Code of Ethics that can be found at:
http://www.uoguelph.ca/engineering/undergrad-counselling-ethics