MECH466 Automatic Control

2nd semester, 2015/16. 9:30-10:50am, Tue MacLeod 202; Thu MacLeod 228

Instructor Information

Instructor	Email	Office Location & Hours
Dr. Ryozo Nagamune	nagamune@mech.ubc.ca	Kaiser 3104 Drop-in or by-appointment

General Information

Course Description and Goals

This course is an introductory course on automatic control. The main goal of the course is to provide the students with basic tools in modeling, analysis and design for linear feedback control systems. Students will learn how to model mechanical, electrical, and electromechanical systems as differential equations and transfer functions. The analysis in this course includes stability of open-loop and closed-loop systems, time responses and frequency responses of low order systems. The design methods are divided into root-locus techniques and frequency response techniques using Bode plots for designing PID and lead/lag controllers. Students will also learn how to apply control theory to real engineering problems with Matlab/Simulink and through laboratory exercises.

This course will give the basic knowledge for more advanced control courses, such as state-space control techniques, nonlinear control, robust control, optimal control, adaptive control, digital control, sampled-data control, hybrid control, and system identification.

Course Materials

Required Textbooks: None

Optional Textbooks

Feedback Control Systems (Custom Edition for UBC MECH466) C. Phillips and J. Parr, Prentice Hall, 2011.

Control Systems Engineering (7th Edition) N. S. Nise, Wiley & Sons, 2014.

Feedback Control of Dynamic Systems (7th Edition) G. Franklin, J. Powell, and A. Emami-Naeini, Prentice-Hall, 2014.

Modern Control Engineering (5th Edition) K. Ogata, Prentice Hall, 2009.

Modern Control Systems (12th Edition) R. Dorf and R. Bishop, Prentice Hall, 2010.

Mechatronics: An Integrated Approach C. W. de Silva, CRC Press, 2004.

Feedback Systems: An Introduction for Scientists and Engineers K. J. Astrom and R. M. Murray, Princeton University Press, 2008. http://www.cds.caltech.edu/~murray/amwiki/Main_Page

Exam Schedule (tentative)

Date	Subject
February 25 (Thursday)	Midterm (Topics to be covered will be announced later.)

Date	Subject
April (TBD)	Final (All topics may be covered.)

Course Schedule (tentative)

Week	Topic
1-2	Introduction, Laplace transform, Modeling
3	Stability, Routh-Hurvitz stability criterion
4-5	Time response
6-7	Root locus
8	Frequency response
9-10	Nyquist stability criterion
11-12	Frequency shaping, Summary

Additional Information and Resources

Exam Policies

- Closed-book. Calculators are not allowed.
- One page letter-size hand-written cheat-sheet (both sides) is allowed.
- Alternative exams can be arranged ONLY for medical reasons and with doctor's notes. For other reasons, discuss your case with the instructor before the exam dates.

Laboratory exercises

Students are required to conduct four 2-hour laboratory exercises.

- Water tank level control
  - Lab 1: January 18-29
  - Lab 2: February 1-12
- DC motor control, including MATLAB exercises
  - Lab 3: March 7-18
  - Lab 4: March 21-April 1

Grading Scheme (Tentative. The instructor reserves the right to change the scheme.)

Laboratory exercise (10%), Homework (10%) Mid-term (20%), Final (60%)

Academic Integrity

The academic enterprise is founded on honesty, civility, and integrity. As members of this enterprise, all students are expected to know, understand, and follow the codes of conduct regarding academic integrity. At the most basic level, this means submitting only original work done by you and acknowledging all sources of information or ideas and attributing them to others as required. This also means you should not cheat, copy, or mislead others about what is your work. Violations of academic integrity (i.e., misconduct) lead to the breakdown of the academic enterprise, and therefore serious consequences arise and harsh sanctions are imposed. For example, incidences of plagiarism or cheating may result in a mark of zero on the assignment or exam and more serious consequences may apply if the matter is referred to the President’s Advisory Committee on Student Discipline. Careful records are kept in order to monitor and prevent recurrences. Link to the relevant Calendar section: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=3,286,0,0