Université d'Ottawa
Faculté de génie

Département de
génie mécanique

uOttawa

University of Ottawa
Faculty of Engineering

Department of
Mechanical Engineering

MCG 3307: Control Systems II

Summer 2012 (2X)

Instructor: Dr. Davide Spinello
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phone: 613.562.5800 ext. 2460
office hours: Take an appointment by email

Lectures: VNR 3035
Monday 8:30 - 11:30
Wednesday 8:30 - 11:30

Tutorials:
Monday 17:00 - 19:00, CBY B02 (computer room)
Thursday 17:00 - 19:00, CBY D207

Textbook: two editions (fourth and fifth) of the textbook (see below) are allowed. For the rest of the syllabus the two editions will be distinguished by enclosing between square brackets entities referred to the fourth edition (for example "Ch. 6" will be referred to the fifth edition, whereas "[Ch. 6]" will be referred to the fourth edition).

Ogata, K.: *Modern control engineering - Fifth edition.* Prentice Hall, 2009
Ogata, K.: *Modern control engineering - Fourth edition.* Prentice Hall, 2001

Matlab online tutorials:
`http://www.mathworks.com/academia/student_center/tutorials/mltutorial_launchpad.html`

Web page: `http://by.genie.uottawa.ca/~spinello/webpage/teaching.html`

TAs:

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Course Outline

Systems response analysis: Chapter 5
General structure of controllers; First order systems; Higher order systems; Routh's stability criterion; Integral and derivative control actions: effects on systems performance; Steady-state errors.

Root-locus method: Chapter 6 [Chapters 6 and 7]
The concept of root-locus; Rules for constructing root-loci; Root-locus analysis of control systems; Control-systems design by the root-locus approach.

Frequency-response method: Chapter 7 [Chapters 8 and 9]
Response to sinusoidal inputs; Bode diagrams; Experimental determination of transfer functions; Control-systems design by the frequency-response approach.

Description and objectives

This course presents the concepts of transient and steady-state response analysis for control systems, assess the stability of control systems through the root-locus method and the frequency-response method, and teaches methods for designing controllers that correspond to desired system behaviours. Students will develop the capability of analyzing the stability of a system and of designing simple controllers to regulate systems behaviour.

Exams: policy and dates

All exams will be closed book - closed notes. A formula sheet will be provided by the instructor if necessary.

Illegible work and loose sheets will not be graded. If a student cannot attend a test/exam due to a medical condition, certified by a doctor, he/she must notify the instructor in advance. Unexcused absence from an exam will result in a grade of 0 for that exam.

The date of the of the mid-term exam can be changed within the first week of class, according with specific exigences of the students.

Mid-term exam Friday, July 13

Final exam TBD

Computer oriented assignments

Three computer oriented homeworks will be assigned during the term. Assignments will be individual. Students are required to use Matlab and to return the assignments in a report format. There will be tutorial sessions, given in a computer lab, dedicated to problems solving with Matlab.

Marks

Marks from computer oriented assignments and mid-term exam determine the semester mark S, computed as follows:

Mid-term exam	60%
Computer oriented assignments	40%
Total of semester (S)	100%

This mark will be combined with the final exam mark F in the following way:

$$0.6F + 0.4S$$

If $F < 55\%$, regardless of the mark of the semester S the overall course grade will be F.

Regulations on Academic Fraud

The following link provides information regarding academic fraud, including the Regulation on Academic Fraud which provides information on the definition of fraud, the disciplinary process and the consequences of dishonest behaviour: `http://web5.uottawa.ca/mcs-smc/academicintegrity/regulation.php`

Suggested problems

5th edition

Chapter 5: B-5-2, B-5-5, B-5-8, B-5-20, B-5-21, B-5-23, B-5-27, B-5-28
Chapter 6: B-6-1, B-6-3, B-6-4, B-6-6, B-6-10, B-6-15, B-6-18, B-6-19, B-6-20, B-6-23, B-6-26
Chapter 7: B-7-2, B-7-5, B-7-9, B-7-11, B-7-23, B-7-26, B-7-30, B-7-32, B-7-34

4th edition

Chapter 5: B-5-2, B-5-6, B-5-10, B-5-23, B-5-25, B-5-27, B-5-31, B-5-32
Chapter 6: B-6-1, B-6-4, B-6-6, B-6-9, B-6-14
Chapter 7: B-7-7, B-7-10, B-7-11, B-7-12, B-7-16, B-7-20
Chapter 8: B-8-2, B-8-6, B-8-11, B-8-13, B-8-26, B-8-29
Chapter 9: B-9-2, B-9-5, B-9-9

Tentative lecture schedule

Lecture	Reading	Topic
1: Mo Jun 18	5-1; 5-2; 5-3 [5-1; 5-2; 5-3]	Course introduction and overview; First and second order systems
2: We Jun 20	5-3; 5-4 [5-3; 5-4]	Second order systems; Higher order systems
3: Mo Jun 25	5-6; 5-7 [5-6; 5-7]	Routh's stability criterion; System performance: effects of integral and derivative control actions
4: We Jun 27	5-8 [5-8]	Steady-state errors in unity-feedback control systems
Mon Jul 2		**Canada day**
5: We Jul 4	6-1; 6-2; 6-4 [6-1; 6-2; 6-3; 6-4]	The concept of root-locus; Root-locus plots; Root-locus plots of positive feedback systems
6: Mo Jul 9	6-5; 6-6 [7-1; 7-2; 7-3]	Control-systems design by the root-locus approach; Lead compensation
7: We Jul 11	6-7; 6-9 [7-4; 7-6]	Lag compensation; Parallel compensation
8: Mo Jul 16	7-1; 7-2 [8-1; 8-2]	Systems output to sinusoidal inputs; Bode diagrams
9: We Jul 18	7-2 [8-2]	Bode diagrams; The resonant frequency; General procedure to plot Bode diagrams; Minimum phase systems and Nonminimum phase systems; Transport Lag
10: Mo Jul 23	7-7 [8-9]	Relative stability: Phase and gain margins, Phase and Gain crossover frequencies; Cutoff frequency and bandwidth; Cutoff rate
11: We Jul 25	7-9; 7-11 [8-11; 9-2]	Experimental determination of transfer functions; Control-systems design by the frequency-response approach: Lead compensation
12: Mon Jul 30	7-12 [9-3]	Control-systems design by the frequency-response approach: Lag compensation Lag compensation