

SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

ENSC383 – FEEDBACK CONTROL SYSTEMS

COURSE OUTLINE – Fall 2007

OBJECTIVES:

Control systems are present everywhere. Inspired by the use of feedback in nature, human-made technology has benefited from feedback control. Control is essential in various domains, from locomotion devices such as mobile robots to jumbo jets, computer disk drives to communication systems, and washing machines to oil refineries. Many engineers refer to control as *a hidden technology* because of its presence in so many devices while being mainly out of sight.

The objective of this course is to give the student a firm grasp of the essential principles of linear feedback control systems. The course covers analysis and design techniques for linear time invariant systems in frequency and time domains. The material covered in this course is fundamental and is the basis for a wide range of advanced applications.

PREREQUISITE: Linear Systems (ENSC 380)

Topics that will be of prime importance: Linear differential equations, Laplace transforms, modeling of physical systems, impulse and step response, transfer functions, frequency response and Bode plots.

TOPICS:

The following topics will be covered:

1. An overview of feedback control systems
2. Modeling dynamic systems
3. Dynamic response in time and frequency domains; stability concepts; signal flow graphs
4. Properties of feedback; P, PI, and PID controllers
5. Linear feedback system design and analysis techniques: Root locus and frequency response methods

SPECIFIC LEARNING OBJECTIVES:

1. To understand basic properties of feedback systems.
2. To obtain models of dynamic systems in time and frequency domain for the purpose of feedback control
3. Analyze feedback systems containing linear elements
4. To understand the design procedure for feedback control systems
5. To utilize computer software for design and analysis of feedback control systems

CONTACT HOURS: 3 lecture hours per week, 3 laboratory hours every two weeks

COURSE WEB PAGE:

All relevant information about this course will be posted on the following page:
<http://www.ensc.sfu.ca/~mmoallem/ENSC383/ensc383.html>.

TEXTBOOK: Gene Franklin, J. David Powell, and Abbas Emami-Naeini, *Feedback Control of Dynamic Systems*, Prentice Hall, NJ (5th edition: ISBN 0-13-149930-0).

EVALUATION:

The final course grade will be determined from a student's performance on quizzes, assignments, laboratory, mid-term, and final examinations. The weighting of each of these components will be as follows:

Grade Component	Percentage of overall mark
Assignments & Quizzes (approximately 5A+5Q)	10%
Laboratories	18%
Mid-Term Examination (1.5 hours)	22%
Final Examination (2.5 hours)	50%

1. For more information about the course please refer to the course web page which will be updated during the course.
2. For each student, the lowest mark on one Assignment and one Quiz will be dropped.
3. You must try to solve and hand in all questions in each assignment. However, only two or three randomly selected questions will be marked for each assignment.
4. There will be a penalty of 20% per day for late submissions of assignments and lab reports.
5. To pass the course, a student has to attend the labs, perform experiments, and submit reports. In other words, a student cannot pass the course if he/she does not pass the laboratory component of the course.
6. There will three labs centered around a torsional system. The purpose is to illustrate and apply the concepts learned in the lectures. Lab work will be performed in groups (up to 3 students per group). One written lab report per group is expected for each experiment. The first set of labs will be handed out about two weeks after the term starts.
7. The mid-term and final examinations are closed book but one double sided crib sheet containing only formulas will be allowed. The crib sheet should not contain any solved problems and has to be submitted with the exam paper.
8. A calculator with no program and data in memory is permitted on the mid-term and final exams.
9. If a student misses the midterm exam for any *legitimate* reason approved by the University, then his/her final exam will be counted as 70% of the total mark, i.e., there will be no make-up exams for the midterm exam.

ATTENDANCE:

The students should regularly attend classes to take notes and participate in class discussions and quizzes. The material covered in class will not be posted on the web page and not all the material will be in the textbook.

COURSE INSTRUCTOR:

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TEACHING ASSISTANT:

Mr. Qing Wu (qingw@sfu.ca) at the Burnaby campus

CONSULTATION HOURS:

You may drop by my office for any questions regarding the course. However, if you want to make sure that I will be available, please make an appointment by email or phone call, or let me know after the class. When making an email inquiry, please indicate the times you will be available so that I can arrange for a mutually convenient time. You may also get assistance from the Teaching Assistant.