MECH ENG 751: ADVANCED MECHANICAL ENGINEERING CONTROL SYSTEMS Fall 2025

INSTRUCTOR: Dr. Gary Bone
E-Mail: gary@mcmaster.ca

OBJECTIVE:
The objective of this course is to provide a practical introduction to several advanced methods for digital control of dynamic systems. For each method the control philosophy, advantages, limitations, and example applications will be emphasized over mathematical details. Computer simulations will be used to demonstrate theoretical results.

COURSE OUTLINE:

1. INTRODUCTION TO ADVANCED DIGITAL CONTROL
2. MODELLING OF SAMPLED-DATA SYSTEMS
3. SAMPLING RATE SELECTION
4. CONTROLLER DESIGN USING EMULATION OF CONTINUOUS SYSTEMS
5. DIRECT DIGITAL DESIGN
6. DESIGN CONSIDERATIONS FOR ROBUST CONTROL
7. FEEDFORWARD CONTROL
8. STATE SPACE METHODS FOR CONTROL AND ESTIMATION
9. OPTIMAL FEEDBACK CONTROL AND OPTIMAL ESTIMATION
10. LONG RANGE PREDICTIVE CONTROL
11. ADAPTIVE CONTROL
12. ITERATIVE LEARNING CONTROL
13. FUZZY CONTROL
14. DEALING WITH ACTUATOR CONSTRAINTS
15. VARIABLE STRUCTURE CONTROL AND SLIDING MODE CONTROL
16. LABORATORY EXPERIMENTS (If the equipment is available. These are optional)

COURSE NOTES:

A set of course notes will be made available. Please read these notes prior to each lecture.

EVALUATION:

ASSIGNMENTS*: 50%
PROJECT*: 50%

*The assignments and project are to be done on your own. The only person you may discuss them with is Dr. Bone.

McMASTER POLICY REMINDERS:

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty.

The following illustrates only three forms of academic dishonesty:
1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.

Please use this link to obtain more information:

http://www.mcmaster.ca/academicintegrity/students/typeofad/plagiarism/

The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem that cannot be resolved by discussion among the persons involved, individual are reminded that they should contact the Department Chair, the Sexual Harassment Office or the Human Rights Consultant, as soon as possible.
