5B9 Control Engineering II

Lecturers: Mr. Dermot Geraghty (tgerghty@tcd.ie) (Course Co-ordinator)

Semester: 1

Prerequisite Course(s): 3C1, 4B9 or equivalent are useful but not essential.

Course Organisation

The course runs for 12 weeks of the academic year and comprises three lectures per week.

Start Week	End Week	Lectures per week	Lectures total	Tutorials per week	Tutorials total
1	12	3	33		

Note that some lectures will be used for tutorial purposes.

Course Description

This course begins with a review of the concepts of continuous control of Linear Time Invariant systems. The design of compensators using root-locus and frequency response methods is developed in detail.
The development of digital control systems by emulation and by direct methods is then presented.
Time domain methods for control system design are also introduced.
The course also deals with the apparatus of control systems including DC motor drives, stepper motor controllers, frequency inverters etc.,
Two design exercises are used to develop skills in control system design and analysis using Matlab/Simulink.

Learning Outcomes

On successful completion of this course, students will (be able to):

- Describe the dynamical behaviour of controlled processes through use of time and transform domain descriptors
- Explain the role and function of sampling and quantization in digital control loops
- Explain criteria for stability and dynamic response constraints as applied to closed-loop control systems
- Design compensators for closed loop control using industrial controllers
- Model the performance of a complete system including the compensator/ controller
- Understand the operation of AC and DC power control systems as commonly employed in motor control systems e.g. controlled and uncontrolled rectifier bridges

- Understand the control strategies for AC, DC and Stepping Motors and the types of controllers commonly used with these motors i.e. motor drives

Course Content

Review of principles of continuous control systems.
Design of compensators using the Root Locus and Frequency Response methods.
Design of digital controllers by emulation.
Direct design of digital controllers.
The state-space method in control systems design.
PID Controllers
Motor Controllers – DC, AC and Stepping
Process Modelling: Input-output models based on transfer functions and state-space models derived from engineering analysis
System Analysis: basic behaviour of systems in open and closed loop in terms of stability, transient and steady-state responses
Control System Design - specification of the performance of controlled systems and the design of appropriate algorithms.

Course Notes
Notes will be supplied as the course progresses.

Teaching Strategies
The course is taught using a combination of lectures, tutorials and practical design exercises. Students will complete two control system design exercises using Matlab and Simulink. Details will be given during the course.

Assessment Modes
An annual written examination (60%) and two design exercises (40%).

Recommended Texts
Franklin, G.F., J.D. Powell, and M.L. Workman, Feedback Control of Dynamic Systems, 4th Edition, Addison-Wesley, Chapter 8.
Franklin, G.F., J.D. Powell, and M.L. Workman, Digital Control of Dynamic Systems**,** 3rd Edition, Addison-Wesley

Further Information

Any further information will be advised as the course progresses.