

Liverpool John Moores University

Title: Control System Design and Analysis
Status: Definitive
Code: **5305CIT** (125300)
Version Start Date: 01-08-2021

Owning School/Faculty: Engineering
Teaching School/Faculty: Changshu Institute of Technology

Team	Leader
Barry Gomm	Y
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Academic Level: FHEQ5 **Credit Value:** 20 **Total Delivered Hours:** 50
Total Learning Hours: 200 **Private Study:** 150

Delivery Options

Course typically offered: Semester 1

Component	Contact Hours
Lecture	40
Practical	8

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Exam	Exam	Exam	60	2
Report	Prog	Programming	30	
Essay	Coursework	Coursework	10	

Aims

To develop an understanding of components and the principles of control systems, basic design and analysis techniques, and practice some control applications to industrial systems.

Learning Outcomes

After completing the module the student should be able to:

- 1 Demonstrate an understanding of the basic concepts of the automatic control system, the feedback control system and the control mode.
- 2 Demonstrate the ability to establish the transfer functions of the control system with typical links and develop a mathematical model and analyse the system dynamic performance index.
- 3 Demonstrate an understanding of the basic concept of frequency characteristics, and the relationship between frequency characteristics and system stabilities. Be able to use the simulation software to analyse the control system and adjust the system performance according to the analysis results
- 4 Simulate control systems with appropriate software and assess system performance.
- 5 Demonstrate understanding of system components and controller realisation.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Exam	1	2	3	5
Programming	2	4		
Coursework	2	4		

Outline Syllabus

Introduction: control system structure including sensors, controllers, actuators and plants.

Matlab/Simulink

Modelling & Simulation: introduce transfer function models for different plants, how to use Matlab/Simulink to model a dynamic system, how to simulate a control system with Matlab/Simulink for system analysis and performance assessment.

Integration algorithms, State Space representation Time response analysis: characteristics for first order and second order systems, response to step and ramp input.

Controller design: design specification in time domain, functions of P, I and D control, empirical controller parameter setting method.

Industrial control: implementation of PID controllers, proportional and derivative kicks, integral controller wind-up and anti-wind-up method.

Control system hardware design.

Block diagram analysis.

Stability: concept of absolute and relative stability, stability analysis.

Computer packages will be used to gain experience in applying and simulating techniques.

Learning Activities

A series of lectures with some laboratory activities using Matlab

Notes

The module develops an understanding of the modelling, application, design and analysis of control systems with Matlab/Simulink.