Module Specification

Modern Control For Mechatronics Systems

Version: 2026-27, v1.0, 15 Jun 2023

Contents

Part 1: Information

Module title: Modern Control For Mechatronics Systems

Module code: UFMFA1-30-M

Level: Level 7

For implementation from: 2026-27

UWE credit rating: 30

ECTS credit rating: 15

College: College of Arts, Technology and Environment

School: CATE School of Engineering

Partner institutions: None

Field: Engineering, Design and Mathematics

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: Yes

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This hands-on course addresses how to control mechatronics systems using modern state-space techniques. This involves time-domain descriptions of the dynamics of the mechatronics system using state-space system models. The characteristics responsible for the dynamic response of the mechatronics system (poles, zeros, eigenvalues) are presented. Control laws using state-space methods are introduced, including the specification of controller characteristics, pole placement, and optimal (LQR) control. State observers are presented, including

observer design using both pole placement and optimal (Kalman) observers. The implementation of state space controllers and Kalman filters in digital systems is also covered. The learning objectives of the course are achieved using various assessments, including weekly laboratories in which students design control systems for a series of experimental apparatuses.

Features: Not applicable

Educational aims: The module equips students with the knowledge and understanding of theories, principles and applications of modern control techniques for mechatronics systems. This module helps students develop innovative, critical thinking and systems thinking competencies.

Outline syllabus: Introduction to State Space Modelling of mechatronics system and Lagrangian Mechanics
Linearisation of Non-linear Differential Equation and Construction of State Space Models
Modelling Multiple DOF Mechatronics Systems
Conversion between SS to TF and back again: Control canonical, observer canonical, Jordan form
Solution to state equations, poles, zeros and stability
Controllability and Observability
Feedback Control & Pole Placement
Observers (Estimators) and Optimal Control (LQR)
Optimal Observers (Kalman-Bucy Filters, LQG), Reduced Order Observers and Compensators
Reference Input & Command Tracking
Digital Control

Part 3: Teaching and learning methods

Teaching and learning methods: A combination of lectures and lab demonstrations are used to present core topics from the syllabus.

Laboratory sessions are used for familiarisation with simulation software, hardware

use, and solutions development.

Independent learning includes hours of essential reading and laboratory-based development work outside the scheduled classes.

Students will be expected to maintain a logbook of the work during practical sessions.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Design state space models of dynamic systems.

MO2 Discuss, compare, and evaluate control concepts and methodologies for mechatronics systems.

MO3 Simulate modern control systems for mechatronics applications.

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/F12F3D7B-C52C-9AE3-6FCA-6149E225C79A.html?lang=en&login=1

Part 4: Assessment

Assessment strategy: Assessment of this module (for both sit and resit) consists of the following:

Task 1:
A written examination that assesses the student's understanding of analytical techniques the modern control.

Task 2
Multiple laboratory assignments carried out periodically during the semester. This is used to assess competency in the technical aspects taught during the semester. The coursework assessment regime here has been devised to provide regular feedback and feed forward to assist students' progression in fundamental mechatronics principles and to prepare them for the examination.

Task 3:
A group project report (2500 words) and a demonstration in Semester 2.

Assessment tasks:

Examination (Online) (First Sit)
Description: Examination
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2

Laboratory Report (First Sit)
Description: Laboratory report
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested: MO3

Report (First Sit)
Description: Group Project Report (2500 words)
Weighting: 25 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO2, MO3

Examination (Online) (Resit)
Description: Examination
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2

Laboratory Report (Resit)
Description: Laboratory report
Weighting: 25 %
Final assessment: No
Group work: No
Learning outcomes tested: MO3

Report (Resit)
Description: Group Project Report (2500 words)
Weighting: 25 %
Final assessment: No
Group work: Yes
Learning outcomes tested: MO2, MO3

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Mechatronics Engineering [Frenchay] MEng 2023-24