IMPERIAL

Module Specification

Basic details

				Earliest cohort	Latest
UID		Cohorts covered			

Long title: Digital and Data-Driven Control Systems

New code	ELEC70090	New short title	

Brief description of module *(approx. 600 chars.)*

The aim of the module is to provide a well-rounded exposure to analysis, control and simulation of digital control systems. Theoretical techniques for studying discrete-time linear systems with particular emphasis on the properties and design of sampled-data feedback control systems will be introduced and supported by MATLAB simulations.

340 characters

Available as a standalone module/ short course? No

Statutory details

	ECTS	CATS	Non-credit		
Credit value	5	10	N	HECOS codes	
FHEQ level	L7				

Allocation of study hours

	Hours	
Lectures	20	
Group teaching	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	105	*Incl. wider reading/ practice, follow-up work, completion of assessment*
Placement	0	*Incl. work-based learning and study that occurs overseas.*
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? 0

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 1	Other	

Ownership

Primary department	Department of Electrical and Electronic Engineering
Additional teaching departments	0
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery? 0

External institution
External department
External campus

Associated staff

Role	CID	Given name	Surname
Module Leader		Yulong	Gao
		0	0
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		0	0

Learning and teaching

Module description

Learning outcomes

By the end of the module you will be able to:
1) Illustrate the issues related to the discretization of continuous-time systems;
2) Devise basic discrete-time control systems using the z-transform and the w-transform;
3) Devise advanced discrete-time control systems using frequency-response methods;
4) Employ the relation between state-space representations and frequency-domain representations;
5) Apply basic principles of optimal control;
6) Devise optimal control laws to solve the linear quadratic regulator problem;
7) Use MATLAB to aid the analysis and design of discrete-time control systems;
8) Relate the introduced ideas and tools with the general theory of dynamical systems

Module content

Aspects of digital signal processing and digital control implementation;
z- and w-transforms;
Impulse sampling and data hold;
The pulse transfer function;
Mapping between the s-plane and the z-plane;
Stability analysis in the z-plane;
Synthesis using indirect and direct design techniques to achieve stability and performance;
Analysis and synthesis in state-state;
Optimal control and dynamic programming principle;
Linear quadratic regulator problem;
Linear quadratic Gaussian control problem;
Behavioural theory and fundamental lemma;
Direct data-driven control design: stabilization and optimal control.

Learning and Teaching Approach

This module is taught as a traditional module with theoretical lectures supported by exercises and examples. The lectures cover the topics from a theoretical point of view. Concepts, problems and solution methods are explained and justified from a theoretical and intuitive point of view.

Assessment Strategy

The module is assessed by a 3-hour, closed book, written examination (75%) and by a coursework component (25%).

Feedback	Formative feedback will be provided on an ongoing basis in the classroom. All deliverables will receive formative feedback. Summative feedback will be provided as provisional letter grades.
Reading list	Supplemental Reading [1] K. Ogata, Discrete-time control systems, 2nd ed. Englewood Cliffs, N.J. : Prentice Hall, 1995. [2] C. L. Phillips, Digital control system analysis & design, Fourth edition, Global edition. Harlow, Essex : Pearson Education Limited, 2015. [3] G. F. Franklin, Feedback control of dynamic systems, Seventh edition.; Global edition. Harlow : Pearson Education Limited, 2015.

Quality assurance

Date of first approval	February 2022
Date of last revision	May 2024
Date of this approval	
Module leader	Yulong Gao

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments	

Template version #####

Assessment details

		Pass mark
Grading method	Numerical	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	Final examination	75%	50%	N
Coursework	Coursework with report	25%	50%	N
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
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0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
0	0	0%	0%	0.00
		100%		