IMPERIAL

Module Specification

Basic details

UID		Cohorts covered	Earliest cohort	Latest c

Long title: Predictive Control

New code: ELEC70028

New short title:

Brief description of module *(approx. 600 chars.)*: This module will provide you with an understanding of the fundamental principles in predictive control, which is the most widely used advanced control technique in industry. The emphasis of this module is on multivariable systems with constraints. This module will give an introduction to some of the formulations currently employed in industry and show how to solve challenging optimal control problems by using state-of-the-art optimisation methods. A significant component of the module includes results that have been developed in academia during the last decade, and aims to provide you with a solid theoretical basis for understanding current and future implementations of predictive control. By the end of the course, you should be able to design and implement your own optimisation-based controllers for the real-time control of a nonlinear system using industry-standard software.

889 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	10	
Group teaching	9	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	1	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	105	*Incl. wider reading/ practice, follow-up work, completion of assessments*
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? No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 2	Other	

Ownership

Primary department: Department of Electrical and Electronic Engineering

Additional teaching departments	0
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	No

External institution	
External department	
External campus	

Associated staff

Role	CID	Given name	Surname
Module Leader		Eric	Kerrigan
		0	0
		0	0
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		0	0
		0	0
		0	0

Learning and teaching

Module description

Learning outcomes	At the end of the module, you should be able to: - Construct a range of finite horizon optimal control problems with constraints. - Solve constrained finite horizon optimal control problems by formulating them as finite dimensional optimization problems. - Compare the advantages and disadvantages of implementing the solution to finite horizon optimal control problems in a receding-, decreasing- or variable-horizon fashion. - Transfer a real-world control problem into a mathematically well-defined optimal control problem. - Devise predictive controllers with guarantees of stability and feasibility. - Write Matlab programs that implement a predictive controller. - Appraise relatively simple papers on predictive control and be able to extract information from them in order to design a predictive controller.
Module content	Formulation of a variety of optimal control problems with constraints; The receding horizon principle; Transcribing continuous-time and sampled-data control problems into discrete-time control problems; Solving constrained optimal control problems using numerical optimization software; Hard and soft constraints; Linear-quadratic predictive control; Nonlinear predictive control; Introduction to robust predictive control; Introduction to stability and feasibility in receding horizon control
Learning and Teaching Approach	This module is delivered through a selection of pre-recorded lectures and interactive, group-based sessions. There will be a hardware-based laboratory sessions during which you get to experiment with changing the parameters of a predictive controllers on a physical system, with the help of a teaching assistant.

Assessment Strategy

The summative assessment is 100% coursework in the form of reports, code and orals. You will be required to submit short pieces of code-based assignments on a regular basis, which will be automatically marked. You will be required to submit longer code-based assignments and an accompanying short report roughly towards the middle and end of the module. There will also be formative assessment in the form of quizzes and interactive group sessions at the weekly timetabled sessions. A detailed breakdown follows:
- MATLAB Grader assignments (15%)
- Core assignment part 1, including code and report (30%)
- Core assignment part 2, including code, oral and report (50%)
- Laboratory oral (5%)

Feedback

The submitted code will be automatically marked and you will be given feedback on how your code has performed. You will be given feedback on your written reports. You will be given provisional grades for summative assessment components. There will be short quizzes, group-based problems and group discussions during the timetabled sessions for you to get formative feedback on whether you are understanding the prescribed learning material.

Reading list

The reading list is available via the Library’s Leganto system:
https://imperial.alma.exlibrisgroup.com/leganto/readinglist/searchlists/40672461270001591

Quality assurance

Date of first approval:
Date of last revision: May 2025
Date of this approval:

Module leader: Eric Kerrigan

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?
Coursework	Matlab Grader assignments	15%	50%	N
Coursework	Core assignment part 1	30%	50%	N
Coursework	Core assignment part 2	50%	50%	N
Coursework	Laboratory	5%	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
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