Engineering Tripos Part IIB, 4F3: An Optimisation Based Approach to Control, 2018-19

Module Leader and lecturer
Dr G Vinnicombe [1]

Lecturer
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Timing and Structure
Lent term. 14 lectures + 2 examples classes, Assessment: 100% exam

Prerequisites
3F1 and 3F2 useful

Aims
The aims of the course are to:

- introduce methods for control system design based on the optimization of an objective subject to the constraints given by the system dynamics and limits on inputs and states.
- demonstrate how such control laws can be computed and implemented in practice.

Objectives
As specific objectives, by the end of the course students should be able to:

- understand the derivation and application of optimal control methods.
- appreciate the main ideas, applications and techniques of predictive control.

Content
Convex Optimisation (1L, Dr F Forni)
- Formulation of convex optimisation problems
- Status of theoretical results and algorithms

Predictive Control (7L + 1 examples class, Prof J M Maciejowski)
- What is predictive control? Importance of constraints. Flexibility of specifications. Typical applications
- Basic formulation of predictive control problem without constraints and the receding horizon concept. Comparison with unconstrained Linear Quadratic Regulator
- Including constraints in the problem formulation. Constrained convex optimization
- Guaranteeing zero steady state error
- Stability of predictive control
Emerging applications: advantages and challenges

Optimal Control (6L + 1 examples class, Dr F Forni)

- Formulation of optimal control problems. Typical applications
- Optimal control with full information (dynamic programming)
- Control of Linear Systems with a quadratic objective function
- Output feedback: ‘LQG’ control
- Control design with an “H-infinity” criterion

Booklists

Please see the Booklist for Group F Courses [2] for references for this module.

Examination Guidelines

Please refer to Form & conduct of the examinations [3].

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Links
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