

ME-425

Model predictive control

Jones Colin

Cursus	Sem.	Type
Electrical and Electronical Engineering	MA1, MA3	Opt.
Energy Management and Sustainability	MA1, MA3	Opt.
Energy Science and Technology	MA1, MA3	Opt.
Mechanical engineering	MA1, MA3	Opt.
Microtechnics	MA1, MA3	Opt.
Robotics, Control and Intelligent Systems		Opt.
Robotics	MA1, MA3	Obl.
Systems Engineering minor	H	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Provide an introduction to the theory and practice of Model Predictive Control (MPC). Main benefits of MPC: flexible specification of time-domain objectives, performance optimization of highly complex multivariable systems and ability to explicitly enforce constraints on system behavior.

Content

- Review of convex optimization and required optimal control theory.
- Receding-horizon control for constrained linear systems.
- Practical issues: Tracking and offset-free control of constrained systems.
- Theoretical properties of constrained control: Constraint satisfaction and invariant set theory, Stability of MPC.
- Introduction to advanced topics in predictive control.
- Simulation-based project providing practical experience with MPC.

Keywords

Multi-variable control, Constrained systems, Model-based Control, Optimization

Learning Prerequisites**Required courses**

- Automatique or Control Systems

Recommended courses

- Multivariable systems or Dynamic coordination

Important concepts to start the course

- State-space modeling
- Basic concepts of stability
- Linear quadratic regulation

Learning Outcomes

By the end of the course, the student must be able to:

- Design an advanced controller for a dynamic system, A11
- Assess / Evaluate the stability, performance and robustness of a closed-loop system, A12
- Work out / Determine the performance (by simulations or experiments) of a mechatronic system, A21
- Assess / Evaluate Define (specifications) the control performance for mechatronic systems, A18

Transversal skills

- Write a scientific or technical report.

Teaching methods

Lectures, exercises and course project

Expected student activities

- Participate in lectures, exercises and course project
- Homework of about 2 hours per week

Assessment methods

- Reports on weekly exercises
- Report on simulation-based project
- Written final exam

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Bibliography

All material can be downloaded from the moodle site. Printed versions of the lecture notes can be ordered.

Websites

- <http://la.epfl.ch/teaching/mpc>

Moodle Link

- <http://moodle.epfl.ch/course/view.php?id=13231>