

# Course on Model Predictive Control Objectives and syllabus

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# Objectives of the course

## Main objectives

- Provide a comprehensive and technical, yet as simple as possible, description of Model Predictive Control
- Explain the key features for its industrial success
- Explore some current research directions

## Prerequisites

- Basic linear systems theory
- Basic optimization concepts

- 1 Introduction
  - ▶ Introduction to MPC, typical industrial structure, MPC algorithms architecture
  - ▶ Required reminders of linear systems theory
- 2 Linear Model Predictive Control design
  - ▶ Observer, steady-state optimization, dynamic optimization
  - ▶ Closed-loop implementation of the three modules (receding horizon principle)
  - ▶ Quick overview of numerical optimization problems
- 3 Linear Model Predictive Control analysis
  - ▶ Asymptotic (exponential) stability analysis
  - ▶ Offset-free tracking in the presence of plant/model mismatch and/or permanent disturbances
  - ▶ Nominal robustness and robust MPC design
- 4 Nonlinear systems
  - ▶ Nonlinear MPC
  - ▶ Moving horizon estimators
- 5 Research directions
  - ▶ MPC performance monitoring and diagnosis
  - ▶ Efficient and suboptimal MPC algorithms, continuous-time systems, distributed MPC