Optimal control

Faulwasser Timm

**Summary**

This doctoral course provides an introduction to optimal control covering fundamental theory, numerical implementation and problem formulation for applications.

**Content**

Optimization and optimal control play pivotal roles in many engineering applications – ranging from autonomous vehicles, robotics and chemical reactors to smart grids and aeronautics. The course will cover the following topics:

**Basics of optimal control theory**
- Optimality conditions for static problems
- Formulation of optimal control problems
- Gateaux derivative
- Pontryagin Maximum Principle

**Numerical optimal control**
- Indirect methods
- Direct solution methods
- Efficient derivative computation

**Advanced aspects of optimal control**
- Existence of optimal solutions
- Dual variables
- Singular problems
- Dissipativity and turnpike properties

**Receding-horizon control of sampled-data systems**
- Sufficient stability conditions with and without terminal constraints
- Economic cost functions
- Differences of continuous time and discrete time formulations

**Outlook**
Learning Outcomes

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

- Solve control problems arising in their research projects by means of optimal control approaches.

Assessment methods

Project Report.