ME-717

Neural Networks for Optimal Control

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Cursus	Sem.	Type
Robotics, Control and Intelligent Systems		Obl.

Language of teaching	English
Credits	2
Session	
Exam	Oral presentation
Workload	60h
Hours	**22**
Courses	18
Exercises	4
Number of positions	

Frequency

Only this year

Summary

The effectiveness of control algorithms in large-scale cyber-physical systems relies not only on advancements in sensing, computation, and communication but also on the availability of methods to design controllers capable of stabilizing nonlinear systems under nominal operating conditions.

Content

1. Designing Optimal Closed-Loop Maps for Linear Systems
   - Stable transfer matrices, internal stability, Youla parametrization, Internal Model Control (IMC)
   - Convex optimal control over all stabilizing policies: guarantees for both model-based and model-free cases
   - Finite-dimensional approximations and state-space implementations

2. Performance Boosting for Nonlinear Optimal Control
   - Signal-space notation, nonlinear stable operators, L2 gains, and the small-gain theorem
   - IMC parametrization of stabilizing nonlinear policies, robustness for uncertain models
   - NN parametrizations of stabilizing controllers

3. Performance Boosting at Scale
   - Dissipativity for interconnected systems Distributed Performance Boosting

Note

The course will be offered in partnership with the International Graduate School on Control (IGSC) of the European Embedded Control Institute (EECI) and, therefore, will be open to external students (see http://www.eeci-igsc.eu/).

Resources

Moodle Link

- https://go.epfl.ch/ME-717