Nonlinear control theory

Credits: 4    Semester 2    Compulsory: No

<table>
<thead>
<tr>
<th>Format</th>
<th>Lectures 20 h</th>
<th>Examples 12 h</th>
<th>Private study 68 h</th>
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</table>

Lecturers: C.Moog (ECN-UG)

**Course objectives:** The goal is to give the basis of modern nonlinear control theory. Analysis and control of nonlinear systems are considered using a so-called algebraic approach. Examples taken from robotics or electric drives demonstrate the feasibility of the methodology.

**Contents:**
- Introduction to the algebraic approach for nonlinear systems and its mathematical tools.
- Structural analysis, concepts of relative degree, of controllability and observability.
- Control methods: feedback linearization, decoupling, reference trajectory tracking.
- Lyapunov functions and their properties.
- Recursive global stabilization by state feedback of nonlinear systems.
- Design of a nonlinear observer. Special observability forms for input-affine systems.
- Observer-based stabilization. Methods to avoid finite-escape time.
- Dynamic output feedback semi-global stabilization.

**Practical Work:** Exercises, use of computer algebra, case study on an inverted pendulum.

**Objectives:** After completing this course, the students will be able to:
- Understand the theoretical fundamentals on the control of nonlinear systems,
- Apply advanced nonlinear control on a variety of robotics systems,
- Implement control strategy, and calculate the corresponding observer.

**Assessment:** 30% continuous assessment, 70% from end-semester examination

**Recommended texts:**

**Further readings:**