### Control Theory and Applications

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<th>Rota</th>
<th>Duration</th>
<th>Semester</th>
<th>SWS</th>
<th>Credit Points</th>
<th>Workload</th>
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<td>1 Semester</td>
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#### AR-102

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<th>1</th>
<th>Modul Structure</th>
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<td><strong>Course (Abbreviation)</strong></td>
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<td>a)</td>
<td>Control Theory and Applications (CTA)</td>
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<td>b)</td>
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#### 2 Language

**English**

#### 3 Content

- Modeling of dynamic systems: First principles models, state space representation, DAE systems, classes of systems, models, and signals, linearity and causality, steady states, operability, singular value decomposition, stability, linearization.
- Linear state space theory: Autonomous behavior, eigenvalues, eigenvectors, Jordan form, controllability and pole assignment, LQ-optimal control, observability, observers, observer-based control, Kalman decomposition.
- Laplace transform and transfer matrices: Introduction to the Laplace transform, transfer functions, poles, zeros, minimal realization, zeros of multivariable systems, frequency response, input-output stability.
- Design of single-loop controllers: Internal stability, performance specification, classical SISO controller design, robust stability and performance, performance limitations
- Discrete-time and sampled data systems: z-transform, z-transform of sampled data systems, stability, dead-beat control, w-transform

**Literature:**

- Handouts

#### 4 Competencies

This course provides the students with a solid background in control theory which is a prerequisite to solve automation problems in robotics as well as in production processes of all kinds.

#### 5 Examination Requirements

The final exam will be a written (2 hours) exam. In addition, there will be a written midterm exam (1.5 hours).

#### 6 Formality of Examination

- Module Finals
- □ Accumulated Grade

#### 7 Module Requirements (Prerequisites)

#### 8 Allocation to Curriculum:

Mandatory Course
Program: Automation & Robotics

#### 9 Responsibility/ Lecturer

*Prof. Dr. S. Engell/ Prof. Dr. S. Engell*