| Control Theory and Applications | | | | | AR-102 |
|---|---|---|---|---|---|
| **Rota** annually WS | **Duration** 1 Semester | **Semester** 1st (Semester) | **SWS** 5 SWS | **Credit Points** 6 | **Workload** 180 h |

| 1 | **Modul Structure** | | | | |
|---|---|---|---|---|---|
| | **Course (Abbreviation)** | **Type/ SWS** | **Presence** | **Self Study** | **Credit Points** |
| | a) Control Theory and Applications (CTA) | Lecture / 3 SWS | 35 h | 85 h | 4 |
| | b) Control Theory and Applications (CTA) | Tutorial / 2 SWS | 25h | 35 h | 2 |

| 2 | **Language** English |
|---|---|

| 3 | **Content** |
|---|---|
| | 1. 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. |
| | 2. Linear state space theory: Autonomous behavior, eigenvalues, eigenvectors, Jordan form, controllability and pole assignment, LQ-optimal control, observability, observers, observer-based control, Kalman decomposition. |
| | 3. 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. |
| | 4. Design of single-loop controllers: Internal stability, performance specification, classical SISO controller design, robust stability and performance, performance limitations |
| | 5. Discrete-time and sampled data systems: z-transform, z-transform of sampled data systems, stability, dead-beat control, w-transform |
| | **Literature:** |
| | • Handouts |
| | • S. Skogestad, Postlethwaite: Multivariable Feedback Control, Wiley, 1996. |
| | • K. Zhou, J.Doyle: Essentials of Robust Control, Prentice Hall, 1998. |

| 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 mid-term 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.-Ing. S. Engell and Prof. Dr. S. Lucia /* Prof. Dr.-Ing. S. Engell and Prof. Dr. S. Lucia |