<table>
<tr><th colspan="5">Aspects of Mathematical Modeling</th><th>AR-214</th></tr>
<tr><td>Rota
annually WS or SS</td><td>Duration
1 Semester</td><td>Semester
2nd/3rd (Semester)</td><td>SWS
3 SWS</td><td>Credit Points
5</td><td>Workload
150 h</td></tr>
<tr><td>1</td><td colspan="5">Modul Structure
<table>
<tr><th>Course (Abbreviation)</th><th>Type/ SWS</th><th>Presence</th><th>Self Study</th><th>Credit Points</th></tr>
<tr><td>a) Aspects of Mathematical Modeling (AMM)</td><td>Lecture/ 2 SWS</td><td>25 h</td><td>65 h</td><td>3</td></tr>
<tr><td>b) Aspects of Mathematical Modeling (AMM)</td><td>Tutorial/ 1 SWS</td><td>15 h</td><td>45 h</td><td>2</td></tr>
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<tr><td>2</td><td colspan="5">Language: English</td></tr>
<tr><td>3</td><td colspan="5">Content
Different directions of mathematical modeling techniques are introduced that build on the course Advanced Engineering Mathematics and assume a solid background in mathematics. Among the subjects are the following:
1. Optimization: Theoretical and practical aspects of optimization problems, formulation, optimality conditions, linear programming, discrete optimization.
2. Applied partial differential equations: Prototypes, representation formulae, qualitative and quantitative behavior, conservation laws, elliptic, parabolic and hyperbolic equations, convection-diffusion-reaction systems.
3. Continuum mechanics: Inertia and momentum, equations of motion, external forces, conservation laws, deformations.
4. Modeling: Modeling with differential equations: Autonomous systems, linearization, phase plane analysis, non-dimensionalization, network dynamics, stability, bifurcations. Stochastic modeling: statistical inference, stochastic processes.
Literature:
References will be given in the courses.</td></tr>
<tr><td>4</td><td colspan="5">Competencies
This course offers an introduction to different fundamental techniques of mathematical modeling and analysis that are useful for the dynamics and control of robotic devices. Tools that allow for the description and control of movement and the interaction with the environment are introduced. The ability to create and use models to estimate qualitatively and quantitatively the behavior of dynamic systems will be trained.</td></tr>
<tr><td>5</td><td colspan="5">Examination Requirements
The final exam will be an oral (20 minutes) or written (1.5 hours) exam, depending on the number of participants (form will be announced in the second week of the course).</td></tr>
<tr><td>6</td><td colspan="5">Formality of Examination
☒ Module Finals ☐ Accumulated Grade</td></tr>
<tr><td>7</td><td colspan="5">Module Requirements (Prerequisites)
Course: “Advanced Engineering Mathematics”</td></tr>
<tr><td>8</td><td colspan="5">Allocation to Curriculum:
Program: Automation & Robotics, Field of study: Robotics, Process Automation, Cognitive Systems</td></tr>
<tr><td>9</td><td colspan="5">Responsibility/ Lecturer
Dean of the Mathematics faculty / Lecturers of the Mathematics faculty</td></tr>
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