### 1.5 Modelling and Simulation (MAS)

<table>
<thead>
<tr>
<th>Module leader:</th>
<th>Prof. Dr.-Ing. Uwe Apel</th>
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<tbody>
<tr>
<td><strong>ECTS points:</strong></td>
<td>6 ECTS</td>
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<tr>
<td><strong>Workload (h):</strong></td>
<td>180</td>
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<td><strong>Type of module and position in the course of study:</strong></td>
<td>Mandatory module taught in the 1. semester</td>
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<td><strong>Contact hours (h):</strong></td>
<td>56</td>
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<td><strong>Scope und frequency of teaching:</strong></td>
<td>14 classes in winter term</td>
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<td><strong>Self-study (h):</strong></td>
<td>124</td>
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<td><strong>Type of module and position in other study programs or continuing education offers:</strong></td>
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**Learning outcomes:**

Upon completion of this module students will be able to ...

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Implement a basic understanding of the role and methodology of modelling and simulation within the aerospace community
- Extend the basic knowledge of flight controls and the development of models
- Understand the necessity of simulations for training purposes

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- Perform mathematical abstraction of real scenarios
- Develop aircraft simulation models

Communication and cooperation

- Enhancement of collaboration and cooperation abilities by conducting a project in a team setup

Reflection of academic and professional identity

- Conduct critical reviews of simulations by a comparison with real aircraft models

**Course content:**

- Introduction to simulation and simulators
- Motion
- Visualization
- Databases for simulations
- Simulation for training purposes
  - General considerations
  - Regulations and Requirements for training and simulators
  - Methods
- Modelling
  - Flight physics and equations of motion
  - Aerodynamics
  - Modelling and data representation; data sources and their validation
- Components of simulation systems
  - Flight control systems
  - Navigation systems
  - Visualization systems
- Development of an aircraft simulation model
  - Develop a flight model
  - Develop models and create simulation models
  - Validation of simulation model by a comparison with practical flight models

**English**

**Prerequisites:** None

**Preparation/literature:** To be presented and discussed in the first session of the course

**Further information:** Aulis platform to be used
<table>
<thead>
<tr>
<th>Course title</th>
<th>Teaching staff</th>
<th>Contact hours per week</th>
<th>Learning and teaching methods</th>
<th>Examination method(s), scope and duration</th>
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<tbody>
<tr>
<td>Modelling and Simulation MAS</td>
<td>Dennis Zimmer</td>
<td>2</td>
<td>S</td>
<td>PA</td>
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<td>Modelling and Simulation MAS</td>
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