

Module DDM 4203 – Advanced Strength of Materials

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|---|---|-------------------------------|------------------------------------|---|-------------------------------|----------------------------------|----------------------------|-------------------------|
| 1 | <b>Module Number</b><br>4203  | <b>Study Programme</b><br>DDM | <b>Semester</b><br>1               | <b>Offered in</b><br><input checked="" type="checkbox"/> WS <input type="checkbox"/> SS | <b>Duration</b><br>1 Semester | <b>Module Type</b><br>compulsory | <b>Workload (h)</b><br>180 | <b>ECTS Points</b><br>6 |
| 2 | <b>Courses</b>  |                               | <b>Teaching and Learning Forms</b> |   | <b>Contact Time</b>           |                                  | <b>Self-Study Time</b>     | <b>Language</b>         |
|   | a) Lightweight Design   |                               | Lecture                            |   | <b>(SWS)</b><br>4             | <b>(h)</b><br>60                 | <b>(h)</b><br>90           | English                 |
|   | b) Advanced Finite Element Method   |                               | Lecture with Laboratory            |   | 2                             | 30                               |                            |                         |
| 3 | <p><b>Learning Outcomes and Competences</b><br/>Once the module has been successfully completed, the students can ...</p> <p><b>Knowledge and Understanding</b></p> <ul style="list-style-type: none"> <li>Understand the sequence of a linear finite element analysis.</li> <li>Understand in depth the concept of nodes, integration points and interpolation functions.</li> <li>Understand the influence of various factors on the lightweight potential of a structure.</li> </ul> <p><b>Use, Application and Generation of Knowledge</b></p> <p><i>Use and Transfer</i></p> <ul style="list-style-type: none"> <li>Apply the finite element method to analyse the deformation and stress/strain state of a structure.</li> <li>Apply lightweight design concepts in relation to materials and shapes.</li> <li>Analyse the failure behaviour of technical sandwich structures.</li> </ul> <p><i>Scientific Innovation</i></p> <ul style="list-style-type: none"> <li>Optimize sandwich structures for minimum weight under different side conditions.</li> <li>Improve the weight-to-load ratio of structures.</li> </ul> <p><b>Communication and Cooperation</b></p> <ul style="list-style-type: none"> <li>Interpret the results of a numerical simulation and a lightweight optimization and draw admissible conclusions.</li> <li>Present technical contents and discuss them.</li> <li>Communicate and cooperate within the group in order to find adequate solutions for the task at hand.</li> </ul> <p><b>Scientific Self-Conception/ Professionalism</b></p> <ul style="list-style-type: none"> <li>Justify solutions theoretically and methodically.</li> <li>Reflect and assess the abilities of group members.</li> </ul> |                               |                                    |   |                               |                                  |                            |                         |
| 4 | <p><b>Contents</b></p> <p>a) Lightweight Design: Principles and objectives of lightweight design; One-dimensional members (Bars and Beams); Plates and shells; Stability problems; Selected examples of lightweight design</p> <p>b) Advanced Finite Element Method: Theoretical background of FEM, fundamental equations, numerical accuracy and convergence, applications and influence of boundary conditions, nonlinearity (material); lab exercises</p>  |                               |                                    |   |                               |                                  |                            |                         |
| 5 | <p><b>Participation Requirements</b></p> <p>Compulsory: Fundamentals of strength of materials, materials science, engineering mechanics, design and finite element method<br/>Recommended: NA</p>   |                               |                                    |   |                               |                                  |                            |                         |
| 6 | <p><b>Examination Forms and Prerequisites for Awarding ECTS Points</b></p> <p>Advanced Strength of Materials: Written exam, 120 minutes, graded<br/>Advanced Finite Element Method: Individual semester project, not graded</p>   |                               |                                    |   |                               |                                  |                            |                         |
| 7 | <p><b>Further use of Module</b></p> <p>NA</p>   |                               |                                    |   |                               |                                  |                            |                         |
| 8 | <p><b>Module Manager and Full-Time Lecturer</b></p> <p>Responsible: Prof. Dr.-Ing. Steffen Greuling<br/>Lecturer: Prof. Dr.-Ing. Steffen Greuling, Prof. Dr.-Ing. Andreas Öchsner, D.Sc.</p>  |                               |                                    |   |                               |                                  |                            |                         |

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| 9  | <b>Literature</b><br>Lecture Documents; textbook references will be given in the lecture |
| 10 | <b>Last Updated</b><br>02.04.2019  |