

Module MBI - Incomings– Heat Transfer and CHT Simulation

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| 1 | Module Number MBB xxx | Study Programme MBB/MAP | Semester Incomings | Offered in ☑WS ☑SS | Duration 1 Semester | Module Type Elective | Workload (h) 60 | ECTS Points 2 |
| 2 | Courses | | Teaching and Learning Forms | | Contact Time | | Self-Study Time (h) | Language |
| | a) Heat Transfer and CHT Simulation | | Lecture + Lab | | (SWS) 2 | (h) 30 [1 SWS = 15h] | 30 [bitte nur Summe eintragen] | English |
| 3 | <p>Learning Outcomes and Competences Once the module has been successfully completed, the students can...</p> <p>Knowledge and Understanding</p> <ul style="list-style-type: none"> Understand basics knowledge of thermodynamics, fluid mechanics and heat transfer. Recognize the importance of heat transfer. Understand and explain simple heat transfer processes on the basis of heat conduction, convection and radiation. Understand and apply the principles of conjugate heat transfer (CHT) in engineering applications. <p>Use, Application and Generation of Knowledge</p> <p><i>Use and Transfer</i></p> <ul style="list-style-type: none"> Analyze basic heat transfer problems and develop solutions for heat transfer problems. Set up and solve CHT problems using computational fluid dynamics (CFD) tools. Analyze thermal interactions between solid and fluid domains. <p><i>Scientific Innovation</i></p> <ul style="list-style-type: none"> Improve the efficiency of technical systems with respect to heat transfer. <p>Communication und Cooperation</p> <ul style="list-style-type: none"> Interpret technical/physical results from the field of heat transfer and draw reliable conclusions. Competently present and professionally discuss content from the field of heat transfer. Validate and interpret simulation results of heat transfer critically. <p>Scientific Self-Conception/ Professionalism</p> <ul style="list-style-type: none"> Derive recommendations for decisions from a sustainable energy conversion perspective on the basis of the analyses and evaluations made. Justify solutions with respect to renewable energy systems and turbo machines theoretically and methodically. Develop simulation strategies for engineering applications in automotive, aerospace, and energy sectors justify the derived solutions of heat transfer problems theoretically and methodically. | | | | | | | |
| 4 | <p>Contents</p> <p>a) Heat Transfer and CHT Simulation Fundamentals of heat conduction, convection, and radiation (steady/transient). Heat exchangers and transient heat transfer. Governing equations and boundary equations of Conjugate Heat Transfer (CHT). Introduction to simulation techniques and software (STAR-CCM+): Simulation of heat transfer problems including grid generation, boundary setup, coupling of fluid-solid interfaces, post-processing and interpretation of results for the sake of application on engineering heat transfer problems (CFD-Software Lab).</p> | | | | | | | |
| 5 | <p>Participation Requirements</p> <p>Obligatory: Thermodynamics 1, Fluid Mechanics 1 Recommended:</p> | | | | | | | |
| 6 | <p>Examination Forms and Prerequisites for Awarding ECTS Points</p> <p>a) Written examination (60 minutes), graded + Lab reports, not graded</p> | | | | | | | |

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| 7 | Further Use of Module <ul style="list-style-type: none"> • Bachelor thesis (depending on selection of topic) |
| 8 | Module Manager and Full-Time Lecturer <ul style="list-style-type: none"> • Prof. Dr.-Ing. Rainer Stauch (Module Manager) • Prof. Dr.-Ing. Sandra Hartl |
| 9 | Literature <ul style="list-style-type: none"> • Scripts of lectures (including further references) • P. von Böckh, T. Wetzel. Wärmeübertragung. 5. Auflage. Springer Vieweg, Berlin, Heidelberg, 2015. • Incropera, F. P., DeWitt, D. P., Bergman, T. L, Lavine, A. S. Fundamentals of Heat and Mass Transfer, 6. ed., John Wiley & Sons, 2006. • R.B. Bird, W.E. Steward, E.N. Lightfoot: Transport Phenomena. John Wiley & Sons, 2002. • Griesinger, A. Wärmemanagement in der Elektronik. Springer Vieweg. 2019. • Siemens. STAR-CCM+ Documentation - v2402. 2024. |
| 10 | Last Updated 30.01.2025 |