

Module Handbook

Master Manufacturing Technology

Version 1.0, September 30, 2026

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Changes Report

<i>Version</i>	<i>Revisions</i>
1.0 30.09.2026	Update of examination formats and module numbers for the 2026 Program of Studies.

List of Abbreviations

h	Stunden/hours
LP/CP	Leistungspunkte/Credit points
MMT	Manufacturing Technology
P	Projekt/Project
SoSe/SS	Sommersemester/Summer semester
SWS	Semesterwochenstunden/Weekly contact hours
Ü/L	Übung/Exercise
V/E	Vorlesung/Lecture
WiSe/SS	Wintersemester/Winter semester

Glossary

Compulsory module

A compulsory module is a module that must be successfully completed in order to graduate from a degree program within a specific profile. A required module may consist of one or more courses and may span one or, at most, two consecutive semesters. Module exams and partial assessments are completed throughout the course of study, particularly in the form of written exams, presentations or seminar projects, term papers, oral exams, portfolios, poster or project presentations with or without a defense, practical exams, and/or in electronic form. The respective examiners may, with the approval of the examination committee, specify other suitable forms of examination.

Elective module

In the case of a required-elective module, the student may choose one (or more) from a selection of several modules. From this selection, the student must enroll in and successfully complete a specified total number of modules. It is important to note that only those modules from a required-elective catalog that have not already been successfully completed as part of another required-elective catalog may be selected. A required elective module may consist of one or more courses and may span one or, at most, two consecutive semesters. Module exams and partial assessments are completed throughout the course of study, particularly in the form of written exams, presentations or seminar projects, term papers, oral exams, portfolios, poster or project presentations with or without a defense, practical exams, and/or in electronic form. The respective examiners may, with the approval of the examination committee, specify other suitable forms of examination.

Study plan

Study plan M.Sc. Manufacturing Technology							
Semester	Modules and catalogs						CP
1	Bulk Metal Forming 5 CP	Machining Technology I 5 CP	Plastics Technology 5 CP	Elective Catalog 5 CP	Elective Catalog 5 CP	Interdisciplinary Qualification 5 CP	30
2	Sheet Metal Forming 5 CP	Machining Technology II 5 CP	Materials Technology 5 CP	Elective Catalog 5 CP	Elective Catalog 5 CP	Interdisciplinary Qualification 5 CP	30
3	Scientific Project Work MMT 10 CP		Laboratory Work MMT 5 CP	Elective Catalog 5 CP	Elective Catalog 5 CP	Elective Catalog 5 CP	30
4	Master's Thesis MMT (24 weeks) 30 CP						30

Module catalogs

Compulsory Modules

A total of 85 LP must be earned from this catalog.

<i>Nr.</i>	<i>Sem.</i>	<i>LP</i>	<i>Modulbezeichnung</i>	<i>Sprache</i>
MB-1309	1.	5	Bulk Metal Forming	EN
MB-1408	1.	5	Machining Technology I	EN
MB-1605	1.	5	Plastics Technology	EN
MB-9604	1./2.	10	Interdisciplinary Qualification	EN
MB-1409	2.	5	Machining Technology II	EN
MB-1711	2.	5	Materials Technology	EN
MB-1310	2.	5	Sheet Metal Forming	EN
MB-9704	3.	5	Laboratory Work MMT	EN
MB-9204	3.	10	Scientific Project Work MMT	EN
MB-9904	4.	30	Master's Thesis MMT	EN

Elective Modules

A total of 35 LP must be earned from this catalog.

<i>Nr.</i>	<i>Sem.</i>	<i>LP</i>	<i>Modulbezeichnung</i>	<i>Sprache</i>
MB-1710	1.	5	Basics of Materials Technology	EN
MB-2007	1.	5	Fundamentals of Robotics	EN
MB-2104	1.	5	Introduction to Reliability Engineering	EN
MB-1808	1.	5	Measurement Engineering	EN
MB-1908	1.	5	Methode der Finiten Elemente I	DE / EN
MB-2103	1.	5	Quality Management	EN
MB-9804	1./2.	10	Topics in Manufacturing Technology	EN
MB-2105	2.	5	Advanced Methods for Reliability Engineering	EN
MB-1919	2.	5	Advanced Simulation Techniques in Metal Forming I	EN
MB-2009	2.	5	Automation and Handling Systems	EN
MB-1913	2.	5	Computational Optimization	EN
MB-1809	2.	5	Fatigue Behavior	EN
MB-1909	2.	5	Methode der Finiten Elemente II	DE / EN
MB-1915	2.	5	Nonlinear Continuum Mechanics	EN
MB-1312	3.	5	Additive Manufacturing	EN

MB-1311	3.	5	Advanced Simulation Techniques in Metal Forming II	EN
MB-1914	3.	5	Finite Inelasticity	EN
MB-1410	3.	5	Machining Process Simulation	EN
MB-1916	3.	5	Nonlinear Finite Element Method	EN
MB-2106	3.	5	Reliability of Systems and Networks	EN

List of modules

Modul MB-1309: Bulk Metal Forming

English module title: Bulk Metal Forming						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Bulk Metal Forming		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: This module is an alternative to “Umformtechnik I” (in German), and does not require a basic knowledge of forming technology (processes and analyses) in order to be successfully attended. It provides an advanced knowledge of the fundamentals of bulk metal forming technology, the corresponding forming machines, and processes. In addition, theoretical fundamentals with special emphasis on analytical methods are discussed. The lecture is divided into two parts. The first part gives the basics for bulk metal forming. After providing the fundamentals of materials technology with the mechanisms relevant to forming technology, the theory of plasticity is discussed in detail to understand the physics of the processes. It is shown how material properties can be determined with the help of different characterization methods and different analytical methods are introduced to solve forming problems. In the second part processes such as rolling, forging, cold forging, bar extrusion, and shear forming are introduced. The processes are considered both, analytically and technologically. Advantages and applications are presented, and typical defects and limitations are discussed. Further knowledge concerning forming machines is given discussing different press types. Selected processes and their corresponding theories will also be presented in a live demonstration on current research setups in the laboratory to combine theory with practice. As an important motivation for the further development of forming technology, possibilities of resource efficient manufacturing are explained. In exercises, the fundamental theories provided in the lectures are further explained, applied, and the application of analytical models of bulk metal forming processes are practiced. An optional voluntary midterm exam places students in an exam atmosphere, providing an opportunity to engage with exam-level assignments. With optional voluntary quizzes during the semester, the individual learning level will also be tested.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: With the participation of this module, the students have a broad understanding of bulk metal processes and can differentiate between different process types, highlight their characteristics and choose the best process for a given manufacturing task. They possess a broad understanding of components, machinery, tools, measurement and control systems, and automation techniques. Further, students can model the processes analytically and understand the limitations of the modelling. During the exercises, students perform analytical calculations individually. They are able to choose the proper modelling technique, construct the equivalent model and solve for desired quantities, such as forming forces. After participating in the lab visits, students are able to offer in-depth explanations on how the machines of the individual processes work, understand the difficulties of the machines and transfer the working principles to other machines.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a 90-minute written test in English.					

7	Empfohlene Kenntnisse/Recommended knowledge: none	
8	Formale Voraussetzungen/Formal requirements: Not selectable if a course on the fundamentals of forming technology has already been taken in the bachelor's program (e.g., "Umformende Fertigungstechnologie"). Cannot be combined with the modules "Umformtechnik I" and/or "Umformtechnik II".	
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules	
10	Modulbeauftragte*r/Module coordinator: Korkolis	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://iul.mb.tu-dortmund.de/en/education/	

Modul MB-1310: Sheet Metal Forming

English module title: Sheet Metal Forming					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester	
				LP/CP: 5,0	Aufwand/ Workload: 150 h
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP
	1	Sheet Metal Forming		V(2)+Ü(2)	5,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: This module is a continuation of “Bulk Metal Forming” (English course) and thus an alternative to the German course “Umformtechnik II”. It provides advanced knowledge of the fundamentals of sheet metal forming technology and the corresponding forming machines and processes. In addition, theoretical fundamentals with special emphasis on analytical methods are discussed. After providing the fundamentals of sheet metal forming and discussing the membrane theory, conventional applications such as sheet and profile bending, deep drawing and roll forming as well as incremental forming, cutting and joining by forming, hydroforming, and impulse forming are discussed in detail. Selected processes and their corresponding theories will also be presented in a live demonstration on current research setups in the laboratory to combine theory with practice. In additionally offered exercises, the fundamental theories provided in the lectures are further explained, applied, and the application of analytical models of sheet metal forming processes are practiced. An optional voluntary midterm exam places students in an exam atmosphere, providing an opportunity to engage with exam-level assignments. With optional voluntary quizzes during the semester, the individual learning level will also be tested.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: With the successful participation of this module, students have a broad understanding of different sheet metal forming processes and are able to differentiate and highlight the characteristics. They possess a broad understanding of components, machinery, tools, measurement and control systems, and automation techniques. Further, the students will be able to model the process analytically and understand the limitations of modeling to identify specific problems and provide solutions for sheet metal forming tasks. Based on analytical calculations performed in the exercises, students are able to choose the proper modelling technique, construct the equivalent model and solve for desired quantities, such as forming forces. After participating in the laboratory visits, students are able to offer in-depth explanations on how the machines of the individual processes work, understand the difficulties of the machines and transfer the working principles to other machines. The lecture, exercise and laboratory visits extend students’ analytical thinking				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a 90-minute written test in English.				
7	Empfohlene Kenntnisse/Recommended knowledge: It is recommended to take this course after “Bulk Metal Forming”.				

8	Formale Voraussetzungen/Formal requirements: Not selectable if a course on the fundamentals of forming technology has already been taken in the bachelor's program (e.g., "Umformende Fertigungstechnologie"). Cannot be combined with the modules "Umformtechnik I" and/or "Umformtechnik II".	
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules	
10	Modulbeauftragte*r/Module coordinator: Korkolis	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://iul.mb.tu-dortmund.de/en/education/	

Modul MB-1311: Advanced Simulation Techniques in Metal Forming II

English module title: Advanced Simulation Techniques in Metal Forming II						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Advanced Simulation Techniques in Metal Forming II		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: Commercial program systems are used both in research and in industrial applications for the analysis of forming processes using the finite element method (FEM). The physical phenomena occurring in forming technology require the use of non-linear FEM in process simulation. The different types, material, geometric and contact nonlinearities, are first reviewed, including the balance relations and kinematic description. Also, constitutive material models for (elasto-) plasticity are presented. Another aspect is the FEM for rigid-plastic material behavior, which is important for bulk metal forming. Based on this, further important aspects such as discretization procedures, advanced meshing approaches, thermomechanical coupling for use in warm and hot forming, failure modelling and related research advancements, as well as verification, validation, and result interpretation are considered. Critical questioning of the assumptions and boundary conditions is essential for that. In To strengthen the link to real-world forming problems, the implementation of the theory in commercial programs is illustrated. Simulations of various application-oriented forming processes are carried out for this purpose. Beyond the standard tools, an introduction to subroutine development and automated analysis is provided.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: After successful participation, students are able to • explain the derivation of various balance relations and their discretized version relevant for finite element analysis, • choose the appropriate modeling approach (elasto-plastic, rigid-plastic, explicit/implicit time integration) for a given forming technology related problem, • critically assess the influence of a chosen contact formulation, • choose the appropriate material model regarding the requirements of a given problem, • select and perform the verification and validation procedures in order to ensure transferability of their FE-based simulations, • critically reflect the results generated using different modeling techniques.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital As a module exam, students take a written exam on topics covered in the module and on a project assignment set in advance (duration: 60 minutes). The details of the project assignment are announced by the instructor at the beginning of the course.					
7	Empfohlene Kenntnisse/Recommended knowledge: Before attending the lecture “Advanced Simulation Techniques in Metal Forming II” it is recommended to attend the lecture “Advanced Simulation Techniques in Metal Forming I”.					

8	Formale Voraussetzungen/Formal requirements: none	
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules	
10	Modulbeauftragte*r/Module coordinator: Korkolis	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://iul.mb.tu-dortmund.de/en/education/	

Modul MB-1312: Additive Manufacturing

English module title: Additive Manufacturing						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Additive Manufacturing		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: The lecture “Additive Manufacturing” (AM) describes the principles and characteristics along the process chain of the layer-wise production of components. As a part of the process chain the lecture deals at first with topics regarding the generation of manufacturing data, which is divided into the steps of data preparation, data conditioning and data processing. One of the main emphases of the lecture is the description and explanation of the most important AM process categories on which commercially available technologies are based on. These include Powder bed fusion, Vat photopolymerization, Material jetting, Material extrusion, Binder jetting, Sheet lamination and Directed energy deposition. As additional contents various methods for post-processing of components are discussed in the lecture as well as the cost-effectiveness depending on different factors.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Students learn the basics and applicational fields of Additive Manufacturing processes based on DIN EN ISO 52900. In addition to the basics, practical and technical knowledge is provided for the proper selection of the manufacturing process, the preparation of the component and the selection of the appropriate manufacturing process.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a 60-minute written test in English.					
7	Empfohlene Kenntnisse/Recommended knowledge: none					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*r/Module coordinator: Korkolis			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance Teacher: Prof. Dr.-Ing. Jan T. Sehrt https://iul.mb.tu-dortmund.de/en/education/
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Modul MB-1408: Machining Technology I

English module title: Machining Technology I						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester	Studienabschnitt/ Study phase: 1. Semester	LP/CP: 5,0	Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Machining Technology I		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: The module “Machining Technology I” imparts knowledge about the fundamentals of machining concerning the chip removal, energy transformation and mechanical loads. Furthermore, individual machining processes are covered, distinguished according to the categories of cutting processes and abrasive processes. Lastly, the topics of lubrication and cooling, tool coating and tool wear are discussed.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: After successful participation in this module, students will be able to describe the basic processes involved in machining and explain the process from a mechanical and energetic point of view. The students will be able to explain the tool wear, cutting materials and cooling lubricant concepts for solving problems concerning specific cutting tasks in the area of both geometrically undefined and geometrically defined cutting edges. Furthermore, the students are able to analyze and compare methods for process evaluations and select them in the context practical issues.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a 90-minute written test in English.					
7	Empfohlene Kenntnisse/Recommended knowledge: none					
8	Formale Voraussetzungen/Formal requirements: Not selectable if the course “Spanende Fertigungstechnologie II” has already been taken in the bachelor's program.					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules					
10	Modulbeauftragte*/r/Module coordinator: Biermann			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://isf.mb.tu-dortmund.de/en/studies/
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Modul MB-1409: Machining Technology II

English module title: Machining Technology II					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester	
				LP/CP: 5,0	Aufwand/ Workload: 150 h
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP
	1	Machining Technology II		V(2)+Ü(2)	5,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: Within the “Machining Technology II” lecture, different designs and essential components of cutting machine tools are covered in the course. This is followed by important operating equipment and fixtures with their functions and interfaces. The modular principle for fixtures and hydraulic fixtures are explained. This is followed by the treatment of tools followed by special design features for machine tools for high-speed and dry machining. In addition, peripheral systems for simulation as well as for the digitalization of cutting processes in the context of Industry 4.0 are presented. The exercise covers the basic procedure for selecting a machine tool. The students work in groups on a practical problem from the field of machining. The topic includes the virtual procurement of a machine tool for a component to be machined.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Students will be able to explain the basic functions and essential components of machine tools and the associated devices and tools. They will be able to distinguish between different types of cutting machine tools. The students are able to categorize types and machine concepts and to select suitable ones for given, also special cutting processes. After successful completion of the exercise, the students have a basic knowledge of planning and designing a cutting process and selecting a machine tool suitable for the process. They are able to draw up a work plan with the appropriate cutting tools for a component to be machined and to calculate the relevant parameters for machine selection. Furthermore, the students are able to evaluate the machine tool with the help of technical and economic criteria and to work out an optimal concept for a given cutting process. The students are able to acquire knowledge independently, to work on technical tasks in a team and to communicate results in the form of presentations.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a 90-minute written test in English.				
7	Empfohlene Kenntnisse/Recommended knowledge: none				
8	Formale Voraussetzungen/Formal requirements: Not selectable if the course “Spanende Fertigungstechnologie I” has already been taken in the bachelor's program.				
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules				

10	Modulbeauftragte*r/Module coordinator: Biermann	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://isf.mb.tu-dortmund.de/en/studies/	

Modul MB-1410: Machining Process Simulation

English module title: Machining Process Simulation						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Machining Process Simulation		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: A detailed insight into machining processes is the most important precondition to understand their principle working mechanisms and, hence, to use this knowledge for their planning and optimization. For this reason, modeling and simulation approaches which are capable of deriving predictions for different process values are in the focus of this lecture. Today, such process simulation systems are subject to research on the one hand but they are applied in industry to a certain extend as well, which is mainly driven by the availability of low cost computational power. This lecture deals with the modeling and simulation of machining processes (mainly turning and milling), focusing on the processes themselves. Starting with a definition and classification of different modeling methods such as analytical-empirical, finite-element-based and geometrical-physical, these methods are explained successively. Their working principles are outlined, but restrictions and boundary conditions are discussed as well. Also, one or two systems are presented in live demonstrations.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: The students have an overview of different existing modeling concepts for the simulation of machining processes. They have knowledge about the working principles of these models and of the realization of some of the models in software tools as well. With this knowledge, they are enabled to choose appropriate modeling concepts for the simulation of specific machining processes, with respect to accuracy, efficiency and reliability. In addition, they can assess the validity calculated simulation results.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a 90-minute written test in English.					
7	Empfohlene Kenntnisse/Recommended knowledge: none					
8	Formale Voraussetzungen/Formal requirements: Not selectable if the course "Modellierungsmethoden für Zerspanprozesse" has already been taken in the bachelor's program.					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*/r/Module coordinator: Biermann			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		

11	Literatur/Literature: Recommended reading will be announced during the course.
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance Teacher: apl. Prof. PD Dr.-Ing. Dipl.-Inform. Andreas Zabel https://isf.mb.tu-dortmund.de/en/studies/

Modul MB-1605: Plastics Technology

English module title: Plastics Technology						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Plastics Technology		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: The module “Plastics Technology” intends to gain a deeper knowledge in the field of polymer materials and plastics processing. It provides students with a detailed knowledge about different polymer materials, their molecular structure and processing. The specific characteristic properties of polymer materials, e.g. thermal properties, are discussed and related to processing and applications. Rheological properties with respect to the different measurement setups and modeling methods are an important part to understand the material behavior while processing. With this fundamental knowledge, processing techniques like injection molding, extrusion and additive manufacturing are discussed. Students learn technological aspects as well as rules to design parts made of polymer materials. Within this context, the important connection of application-oriented and processingoriented part design is part of the course.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: This course introduces students to the field of polymers, including their typical characteristics and field of applications. They gain a profound understanding about different types of polymer materials, with a special focus on their application-oriented potential. Besides, they understand how processing and applications are interrelated. This course will enhance the ability of students to evaluate construction materials by using different interdisciplinary methods in order to choose a material for a specific field of application in a systematic way.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a 60-minute written exam in English.					
7	Empfohlene Kenntnisse/Recommended knowledge: none					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules					
10	Modulbeauftragte*r/Module coordinator: Handge			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance <a data-bbox="256 315 754 340" href="https://ikt.mb.tu-dortmund.de/en/teaching/">https://ikt.mb.tu-dortmund.de/en/teaching/
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Modul MB-1710: Basics of Materials Technology

English module title: Basics of Materials Technology						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Basics of Materials Technology		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: This course aims at refreshing and strengthening knowledge in the field of materials engineering and materials technology. The focus lies on the structures of metallic, inorganic, and organic materials, their mechanical, chemical and diffusion properties as well as their processing and fields of application. Be-sides steel, other metallic and non-metallic materials will be discussed and analyzed. Within a practical section, the students will select materials for a specific application within the context of a case study. The course will also provide fundamental insights into the field of material testing and material analysis.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: After successful participation in this module, students will be able to name the different basic groups of materials and to explain the respective material properties based on the underlying basic mechanisms. The students will be able to apply the knowledge they have acquired, e.g. to select suitable materials for a construction or to explain or evaluate a specific material selection.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://lwt.mb.tu-dortmund.de/lehre/
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Modul MB-1711: Materials Technology

English module title: Materials Technology						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Materials Technology		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: The aim of this module is to provide a broad overview of common construction materials as well as advanced materials and their specific characteristics, their typical fields of application as well as their production processes and post-treatment. Furthermore, the students will analyze the microstructure of the different materials and learn about their effect on the materials properties as well as how post-treatments can adjust the properties of the materials for a certain application.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: After successful participation, students are able to name the different material classes and give the basic definitions as well as name representative specific materials for each class. Furthermore, students will be able to describe the specific material properties of each material class and derive limits of each class for their industrial application. Finally, students are able to analyze and derive the materials requirements for a mutual application and choose appropriate materials as well as the suitable post-treatments.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital As a module examination, students write a written exam (90 minutes) or take an oral exam on topics covered in the module or on a project assignment set in advance.					
7	Empfohlene Kenntnisse/Recommended knowledge: It is highly recommended to take the elective course “Basics of Materials and Technology” before.					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules					
10	Modulbeauftragte*r/Module coordinator: Tillmann			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://lwt.mb.tu-dortmund.de/lehre/
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Modul MB-1808: Measurement Engineering

English module title: Measurement Engineering						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester	Studienabschnitt/ Study phase: 1. Semester	LP/CP: 5,0	Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Measurement Engineering		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: This course introduces students to the measurement chain in any manufacturing process by illustrating the path of the measurement signal stepwise from recording to measuring the variable. The course conveys basic concepts and principles of measurement engineering, from measurement methods and sensors in different production fields to data processing by statistical analysis of the measured output to design of experiments. Then the metrology concepts in production measurement technology are treated followed by the application of learned techniques in materials and component testing. Data acquisition and control is an integral part of the course. In interactive lessons, students learn to use the visual programming environment LabVIEW to visualize, create, and code engineering measurement systems. Finally, students are introduced to statistical techniques used in test planning, analysis, and optimization of engineering systems.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Students master basic theoretical and mathematical concepts for process and product optimized selection of appropriate measurement methods and transducers, of measurement in manufacturing and in materials and component testing, of data acquisition and processing and for statistical analysis and design of experiments. Students are able to identify specific problems and possible solutions to deal with this offer. Accompanying exercises expand the students' competencies by improving their analytical thinking, communication, and team skills. Furthermore, they are prepared for further self-studies.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral					

11	Literatur/Literature: Recommended reading will be announced during the course.
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://wpt.mb.tu-dortmund.de/en/teaching/

Modul MB-1809: Fatigue Behavior

English module title: Fatigue Behavior						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Fatigue Behavior		V(3)+Ü(1)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: In addition to materials science aspects of fatigue behavior of metals, the standard of knowledge on relationship between microscopic structure and macroscopic properties is imparted. The characterization of fatigue behavior is performed by mechanical, thermal, electrical and magnetic measurement techniques and transducers. Current fatigue damage accumulation hypothesis and life time calculation approaches are presented. All the stages of fatigue life - crack initiation, crack propagation and final failure - are dealt with the corresponding mechanisms. To understand and correlate the mathematical models in material fatigue and experimental studies, finite element simulations are introduced. Abaqus and nCode programmes are used for understanding of classical fatigue models and promotes to develop the application-oriented models. Tutorials are designed to simulate fatigue life of different industrial components.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Students gain assessment competence for the independent selection of engineering materials on the basis of given component requirements as well as for the targeted use of introduced methods for material characterization. Students´ cross-disciplinary thinking in overall contexts is encouraged and students are able to identify specific problems and possible solutions to deal with this offer. Through accompanying exercises students expand their analytical skills and develop teamwork and communication skills as well as are prepared for further self-studies.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital The examination consists of a 60-minute written exam in English.					
7	Empfohlene Kenntnisse/Recommended knowledge: none					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*r/Module coordinator: Walther			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://wpt.mb.tu-dortmund.de/en/teaching/
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Modul MB-1908: Methode der Finiten Elemente I

English module title: Finite Element Method I						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Methode der Finiten Elemente I		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: Deutsch oder Englisch					
3	Lehrinhalte/Teaching content: [DE] Im Vordergrund des Moduls stehen die algorithmische Formulierung der Methode der Finiten Elemente sowie deren Implementierung. Das Modul beginnt mit der starken und schwachen Form der Impulsbilanz. Diese kontinuierliche Darstellung der Gleichgewichtsbedingung wird mittels Diskretisierung und Assembly-Operation in ein diskretes Randwertproblem überführt. Die Studierenden führen dabei wesentliche Schritte der Implementierung der Methode der Finiten Elemente eigenständig durch und analysieren basierend auf dem somit selbstständig entwickelten Finite-Elemente-Programm verschiedene Randwertprobleme. Als repräsentative technische Anwendungen werden Wärmeleitung und die linearisierte Elastizität für Statik und Dynamik im zweidimensionalen Fall betrachtet. Zur Lösung dieser Problemstellungen werden explizite und implizite Zeitintegrationsverfahren im mehrdimensionalen Fall eingeführt. [EN] The module focuses on the algorithmic formulation of the finite element method (FEM) and its implementation. It begins with the strong and weak forms of the balance of linear momentum. This continuous representation of equilibrium conditions is transformed, via discretization and assembly, into a discrete boundary-value problem. Students independently carry out the essential steps of implementing the FEM and, using the finite element code they develop, analyze various boundary-value problems. Representative engineering applications include heat conduction and linearized elasticity for statics and dynamics in two dimensions. To solve these problems, both explicit and implicit time-integration schemes in multiple dimensions are introduced.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: [DE] Nach erfolgreicher Teilnahme an diesem Modul sind die Studierenden in der Lage, mechanische Systeme zu analysieren, technisch relevante Problemstellungen zu modellieren und eigenständig zu programmieren. Basierend auf dieser Implementierung können die Studierenden erste Problemstellungen der angewandten Mechanik simulieren. Darüber hinaus lernen die Studierenden die Grundgleichungen verschiedener physikalischer Systeme kennen und können sämtliche Schritte bis zur numerischen Lösung dieser Gleichungen selbstständig umsetzen. Sie sind des Weiteren in der Lage, verschiedene Elementtypen und Integrationsordnungen zu unterscheiden, deren jeweiligen Eigenschaften zu benennen und auf dieser Basis optimale Methoden für bestimmte Ziele auszuwählen. [EN] Upon successful completion of this module, students will be able to analyze mechanical systems, model engineering-relevant problems, and independently implement the respective computer code. Based on their own implementations, students can simulate applied-mechanics problems. In addition, students will know the governing equations of various physical systems and can carry out all steps up to the numerical solution of these equations independently. They will also be able to distinguish between different element types and orders of numerical integration, state their respective properties, and select the most appropriate methods for specific objectives.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					

6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital [DE] Als Modulprüfung schreiben die Studierenden eine Klausurarbeit (90 Minuten) oder absolvieren eine mündliche Prüfung zu Themen des Moduls oder zu einer im Vorfeld gestellten Projektaufgabe. [EN] As a module examination, students write a written exam (90 minutes) or take an oral exam on topics covered in the module or on a project assignment set in advance.	
7	Empfohlene Kenntnisse/Recommended knowledge: Mechanik I (Statik), Mechanik II (Elastostatik), Mechanik III (Dynamik), Mechanik IV (Modellierung & Simulation)	
8	Formale Voraussetzungen/Formal requirements: Keine. None.	
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules	
10	Modulbeauftragte*r/Module coordinator: Mosler	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: [DE] Literaturempfehlungen werden während der Veranstaltung bekannt gegeben. [EN] Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://im.mb.tu-dortmund.de/studium/	

Modul MB-1909: Methode der Finiten Elemente II

English module title: Finite Element Method II						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester	Studienabschnitt/ Study phase: 2. Semester	LP/CP: 5,0	Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Methode der Finiten Elemente II		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: Deutsch oder Englisch					
3	Lehrinhalte/Teaching content: [DE] Das Modul befasst sich zentral mit der Modellierung und Implementierung entsprechender Algorithmen zur Berücksichtigung nichtlinearen Materialverhaltens Neben nichtlinearer Elastizität umfasst dies insbesondere Elastoplastizität in ratenabhängiger und ratenunabhängiger Form. Aufgrund der hierarchischen Struktur von Materialien, die sich über mehrere Größenordnungen von atomaren Bindungsmechanismen bis hin zu makroskopischen Bauteildimensionen erstreckt, sind einkalige Modellierungsansätze jedoch zumeist unzureichend, um ein genaues Verständnis komplexen Materialverhaltens zu erlangen. Vor diesem Hintergrund werden Homogenisierungsmethoden sowie deren numerische Umsetzung in Finite-Elemente-Codes behandelt. Darüber hinaus werden spezielle Formulierungen zur Beschreibung von Mikrostrukturen wie beispielsweise materiellen Grenzflächen diskutiert und implementiert. [EN] The module focuses on the modelling and implementation of algorithms for incorporating nonlinear material behavior. In addition to nonlinear elasticity, it includes elastoplasticity in rate-dependent and rate-independent form. The hierarchical structure of materials however extends over several orders of magnitude, from atomic bonding mechanisms to macroscopic component dimensions. Homogenization methods and their numerical implementation in finite element codes are hence discussed, because single-scale modeling approaches are usually insufficient to gain an accurate understanding of complex material behavior. In addition, special formulations for the description of microstructures such as material interfaces are discussed and implemented.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: [DE] Nach erfolgreicher Teilnahme an diesem Modul sind die Studierenden in der Lage, komplexe mechanische Systeme zu analysieren, technisch relevante Problemstellungen zu modellieren und zu programmieren. Basierend auf dieser Implementierung können die Studierenden komplexe Problemstellungen der Mechanik simulieren. Darüber hinaus sind die Studierenden in der Lage, unterschiedliche Methoden und Vorgehensweisen auf ingenieurwissenschaftliche Problemstellungen anzuwenden, sie miteinander zu vergleichen, ihre jeweiligen Vor- und Nachteile zu analysieren und sich anwendungsspezifisch für eine präferierte Methode zu entscheiden. [EN] Upon successful completion of this module, students will be able to analyze complex mechanical systems, model engineering-relevant problems, and implement them in code. Based on their implementations, students can simulate advanced problems in mechanics. Moreover, students will be able to apply different methods and approaches to engineering problems, compare them, analyze their respective advantages and limitations, and select a preferred method tailored to the specific application.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					

6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital [DE] Als Modulprüfung schreiben die Studierenden eine Klausurarbeit (90 Minuten) oder absolvieren eine mündliche Prüfung zu Themen des Moduls oder zu einer im Vorfeld gestellten Projektaufgabe. [EN] As a module examination, students write a written exam (90 minutes) or take an oral exam on topics covered in the module or on a project assignment set in advance.	
7	Empfohlene Kenntnisse/Recommended knowledge: Finite Elemente Methode I	
8	Formale Voraussetzungen/Formal requirements: Keine. None.	
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules	
10	Modulbeauftragte*r/Module coordinator: Mosler	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: [DE] Literaturempfehlungen werden während der Veranstaltung bekannt gegeben. [EN] Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://im.mb.tu-dortmund.de/studium/	

Modul MB-1913: Computational Optimization

English module title: Computational Optimization					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester	
				LP/CP: 5,0	Aufwand/ Workload: 150 h
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP
	1	Computational Optimization		V(2)+Ü(2)	5,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: Optimization is intrinsic to engineering design. Two most important examples in the area of solid mechanics are the identification of model parameters based on experimental data as well as the inverse problems associated with shape and topology optimization, e.g., for designing lightweight components that enhance resource efficiency. However, optimization methods are also widely applied in other fields, including energy, finance, and healthcare. In this context, the module introduces the fundamentals of nonlinear optimization theory and algorithms, covering the formulation of suitable objective functions as well as unconstrained and constrained optimization problems. Both gradient-based and derivative-free methods are addressed. The module also covers the treatment of complex objective functions that depend on the solutions of partial differential equations, for example, objective functions based on forces and displacement fields computed from boundary value problems. Furthermore, the computation of the optimal weights and biases that define neural networks is also discussed. While the lecture focuses on algorithms for constrained and unconstrained optimization, their implementation in computer codes is explored in the exercises.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this module, students will be able to identify methods for optimization, transfer the fundamental concepts and apply them to problems of practical engineering relevance. Moreover, students will be able to apply the learned methods and approaches, compare them, analyze their respective advantages and limitations, and select a preferred method tailored to the application at hand.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: mündlich/oral ☐ digital As a module examination, students take an oral examination on topics covered in the module or on a project assignment set in advance.				
7	Empfohlene Kenntnisse/Recommended knowledge: none				
8	Formale Voraussetzungen/Formal requirements: none				
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules				
10	Modulbeauftragte*/r/Module coordinator: Mosler			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau	

11	Literatur/Literature: Recommended reading will be announced during the course.
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance This module was previously titled 'Parameteridentifikation'. https://im.mb.tu-dortmund.de/en/study/

Modul MB-1914: Finite Inelasticity

English module title: Finite Inelasticity						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Finite Inelasticity		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: Predicting the behavior of inelastic materials requires the development of a physical (constitutive) model and its translation into a mathematical formulation. This approach to material modelling forms the focus of the course. Emphasis is placed on finite deformations (large strains) on the one hand, and on the modeling of inelastic material behavior on the other – including plasticity and damage mechanics. The material modeling is embedded within the framework of continuum thermodynamics and covers theoretical foundations as well as the implementation in terms of computer algorithms of, for example, single-crystal and polycrystalline plasticity.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this module, students will be able to name and explain methods for material modeling in large strain inelasticity and apply them to problems of practical engineering relevance. In addition, students will be able to apply different methods and approaches, compare them, analyze their respective advantages and limitations, and select a preferred method tailored to the application at hand. Students will also be able to evaluate and develop mathematical models including implementation of related algorithms.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: mündlich/oral ☐ digital As a module examination, students take an oral examination on topics covered in the module or on a project assignment set in advance.					
7	Empfohlene Kenntnisse/Recommended knowledge: Nonlinear Continuum Mechanics					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*r/Module coordinator: Mosler			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://im.mb.tu-dortmund.de/en/study/
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Modul MB-1915: Nonlinear Continuum Mechanics

English module title: Nonlinear Continuum Mechanics					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester	Studienabschnitt/ Study phase: 2. Semester	LP/CP: 5,0	Aufwand/ Workload: 150 h
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course	Typ/Type	LP/CP	SWS
	1	Nonlinear Continuum Mechanics	V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: Following an introduction and motivation, the course first covers the fundamentals of nonlinear kinematics. This includes, in particular, the introduction of different configurations and the associated deformation and strain measures of the Seth-Hill family. Essential topics such as compatibility conditions, material frame indifference, and objective time derivatives are also included. Based on this, the section on kinetics focuses primarily on the thermodynamic balance laws, taking into account different stress measures. Particular emphasis is then placed on energy methods and related topics such as energy balance, the Legendre transform, variational principles, and stability analyses. The module concludes with general considerations of material modeling, addressing essential requirements such as convexity properties of energy densities. The material models treated are limited to isotropic and anisotropic elasticity.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this module, students will be able to state and explain the basic concepts and principles of nonlinear continuum mechanics. They will also be able to apply fundamental methods and thereby solve problems independently. In addition, students will be able to analyze and critically evaluate results and underlying issues. Finally, students will be able to perform derivations independently and solve research-oriented problems.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: mündlich/oral				

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://im.mb.tu-dortmund.de/en/study/
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Modul MB-1916: Nonlinear Finite Element Method

English module title: Nonlinear Finite Element Method					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester	
				LP/CP: 5,0	Aufwand/ Workload: 150 h
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP
	1	Nonlinear Finite Element Method		V(2)+Ü(2)	5,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: The lecture covers the fundamentals and engineering applications of the finite element method (FEM) for geometrically nonlinear, three-dimensional problems in solid mechanics. At the start of the module, the relevant balance relations are introduced and discussed in strong and weak form. Thereby, different configurations are addressed and the continuous problem is transferred to its discrete counterpart by means of element-wise discretization. To solve the resulting discrete nonlinear system of equations using the Newton-Raphson method, the related (consistent) tangent operator is derived, and the algorithmic formulation of the finite element method is discussed. In addition to hyperelasticity, detailed emphasis is placed on finite-element modeling of thermoelastodynamics as a fundamental example for the general class of coupled problems. Furthermore, advanced solution strategies such as arc-length methods as well as deformation-dependent loads are discussed. The exercises in this module focus on programming and implementing the methods and algorithms elaborated in the lecture.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this module, students will be able to name and explain the fundamental concepts of the finite element method (FEM) for nonlinear problems at large strains, transfer and apply them to relevant problems in continuum mechanics, and solve such problems independently. Moreover, students will be able to apply different methods and approaches to engineering problems, compare them, analyze their respective advantages and limitations, and select a preferred method tailored to the specific application. In addition, students will be able to implement and solve the discrete equations of the nonlinear FEM independently.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: mündlich/oral ☐ digital As a module examination, students take an oral examination on topics covered in the module or on a project assignment set in advance.				
7	Empfohlene Kenntnisse/Recommended knowledge: Nonlinear Continuum Mechanics				
8	Formale Voraussetzungen/Formal requirements: none				
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules				

10	Modulbeauftragte*r/Module coordinator: Menzel	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://im.mb.tu-dortmund.de/en/study/	

Modul MB-1919: Advanced Simulation Techniques in Metal Forming I

English module title: Advanced Simulation Techniques in Metal Forming I					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester	
				LP/CP: 5,0	Aufwand/ Workload: 150 h
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course	Typ/Type	LP/CP	SWS
	1	Advanced Simulation Techniques in Metal Forming I	V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: The lecture covers advanced engineering applications of the finite element method (FEM) to generally nonlinear, three-dimensional problems, particularly those relevant to simulations in metal forming. The module begins with an introduction to general nonlinear phenomena. Following a first introduction to continuum mechanics including large-strain kinematics, stress measures and balance equations, emphasis is placed on objective stress rates. Subsequently, hyperelastic and hypoelastic material models are introduced, and the differences between the two concepts are discussed. After introducing basics of the finite-element framework for solving specific boundary-value problems, focus is placed on fundamentals of thermo-mechanically coupled problems. Furthermore, specific structural elements – such as beam and shell elements – are addressed. The module concludes with an introduction to different formulations for the solution of contact problems. In addition, particular emphasis is placed on related finite element applications in commercial FEM software including aspects of implementation such as coding user subroutines.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this module, students will be able to name and explain the fundamental concepts and assumptions of specific finite-element-based simulation methods for generally nonlinear problems. They will also be able to transfer and apply them purposefully to problems in metal forming, and solve such problems independently using commercial FEM software. This includes implementing user subroutines and developing application programming interfaces (APIs) to couple the commercial software with external standalone programs.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: mündlich/oral ☐ digital As a module examination, students take an oral examination on topics covered in the module or on a project assignment set in advance.				
7	Empfohlene Kenntnisse/Recommended knowledge: none				
8	Formale Voraussetzungen/Formal requirements: none				
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules				

10	Modulbeauftragte*r/Module coordinator: Menzel	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://im.mb.tu-dortmund.de/en/study/	

Modul MB-2007: Fundamentals of Robotics

English module title: Fundamentals of Robotics					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1. Semester	
				LP/CP: 5,0	
				Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP
				SWS	
	1	Fundamentals of Robotics (FoR)		V(2)+Ü(2)	5,0
				4,0	
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: Facing shortage of skilled workers and relocation of production to high-wage industrial countries, the demand for automation with industrial robots is growing continuously. Knowledge of the various kinematic robot types, their advantages and disadvantages, the specific motion behavior of industrial robots and its mathematical description, the components of automation systems and, of course, aspects of safety are crucial for the proper design of robot systems. This course imparts the basic knowledge required to professionally configure robot cells for given tasks or to be able to assess their design. It covers the basics of automation and industrial robotics and starts with different kinematic robot types, their properties, and applications. It focuses robot kinematics including computation of rotations, usage of Denavit-Hartenberg-conventions to describe kinematic chains and the mathematical description of robot motions as used for robot simulation and control. It also provides basics of motion control and path planning, the systematic design of general handling systems, robot programming including teach-in, interactive and automatic offline-programming as well as robot hardware, accuracy of robot-based motions, aspects of safe robot-cell-design and safety equipment. Their automated programming for new tasks is a key component for economic use and closes a critical gap in digitalization between design and production. It does not only serve to increase their efficiency but also enables significant energy savings, thereby substantially improving their sustainability. These topics are discussed in lectures and trained in tutorials. Topics: • Which different kinematic types of industrial robots do exist and what are their characteristics? • How can the position and path of a robot be calculated? • How can robot motions be programmed and controlled (basics)? • How can robot programming be improved by simulation and offline programming? • Which hardware components are needed for composing a suitable robot-based automation system for a given task? (Kinematic robot types, drive components, internal and external sensors, grippers and effectors for various tasks, safety equipment)				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: After successful completion of the module, students are able to describe and discuss the basics of industrial robotics. They are able to solve mathematical problems related to robot motions and controllers. They are able to assess and compose different solutions for robot applications.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☒ digital The examination is a digitally written exam in English (duration: 60 minutes).				
7	Empfohlene Kenntnisse/Recommended knowledge: Matrix Calculation				

8	Formale Voraussetzungen/Formal requirements: none	
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules	
10	Modulbeauftragte*r/Module coordinator: Schulze Darup	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Craig, John J.: Introduction to robotics: mechanics and control, Pearson, 3rd edition, 2014 (https://katalog.ub.tu-dortmund.de/id/ir01388a:ubd.lobid:990199602530206441 , eBook available) Niku, Saeed: Introduction to Robotics, Wiley, 2nd edition, 2011 (https://katalog.ub.tu-dortmund.de/id/ir01388a:ubd.lobid:990180799290206441) Weber, Wolfgang: Industrieroboter, Leipzig, 3. Auflage, 2017 (https://katalog.ub.tu-dortmund.de/id/ir01388a:ubd.lobid:990206845120206441 , eBook available)	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance Teacher: PD Dr. Jobst Bickendorf https://rcs.mb.tu-dortmund.de/teaching/	

Modul MB-2009: Automation and Handling Systems

English module title: Automation and Handling Systems							
Studiengang/Degree program: Master Manufacturing Technology							
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester			
				LP/CP: 5,0			
				Aufwand/ Workload: 150 h			
1	Modulstruktur/Module structure						
	Nr/No	Element/Lehrveranstaltung/course			Typ/Type	LP/CP	SWS
	1	Automation and Handling Systems (AHS)			V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English						
3	Lehrinhalte/Teaching content: Industrial robots are a valuable tool for mastering current challenges in the manufacturing industry. They enable cost-effective and more sustainable production of increasingly individualized products in high-wage countries and help to overcome the shortage of skilled workers. To be able to do this, robot-based automation systems must be very well adapted to the task at hand. The aim of this course is to systematically look at the requirements of different production processes and translate them into high-performance solutions. Industrial robots are the core component of numerous automation systems for production and handling processes. This course covers production processes like primary shaping, forming, cutting, joining and assembly and examines their requirements on robot design, robot controllers, robot off-line programming, suitable effectors, and automation compatible workpiece design. As simulation based offline-programming is a prerequisite for the effective automation of a growing number of such production processes, simulation systems and offline-programming applications play an important part in this course. Sensor- and vision systems are also covered as essential components of many automation solutions, as well as programmable logic controllers. Topics: • Robot based production processes • Sensors and measuring strategies to compensate inaccuracies of workpieces and automation components • Automation compatible design • Robot effectors, gripper selection, dimensioning of vacuum grippers • Robot controllers, PLC • Application specific offline-programming and simulation systems						
4	Lernziele und Kompetenzen/Learning outcomes and competencies: After a successful completion of the module, students have acquired knowledge about how to design, program, use and operate a robot-based production cell or line as well as automated manufacturing facilities in general. This knowledge enables the students to understand and analyze a broad range of tasks around automation and robotics, to structure them and to find solutions in a systematic way.						
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none						
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital The examination is a digitally written exam in English (duration: 60 minutes).						
7	Empfohlene Kenntnisse/Recommended knowledge: none						

8	Formale Voraussetzungen/Formal requirements: none	
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules	
10	Modulbeauftragte*r/Module coordinator: Schulze Darup	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature: Recommended reading will be announced during the course.	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance Teacher: PD Dr. Jobst Bickendorf https://rcs.mb.tu-dortmund.de/teaching/	

Modul MB-2103: Quality Management

English module title: Quality Management					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1. Semester	
				LP/CP: 5,0	
				Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP
	1	Quality Management		V(2)+P(2)	5,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: This course provides students with the basics of quality management in the broadest sense and serves as a foundation for more advanced courses on specific quality management topics. The course topics covered in detail are: • Introduction to statistics and probability theory to provide the necessary tools for dealing with the rest of the course material • Description and design of measurement systems • A selection of the viewpoints of the quality gurus from a historical perspective • Acceptance sampling in quality control and a comparison of the different perspectives • Statistical process control and control charts • Incorporating quality aspects into the design of components • Quality management systems: ISO9001, Six Sigma, Total Quality Management, etc. The course concludes with a seminar given by a person from industry, depending on availability. In parallel with the lectures, students work individually or in small groups on a practical case study, applying the concepts learned to a practical quality management problem.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of the course, students should have a thorough understanding of the various quality management concepts as described in the course content and be able to perform basic quality management analysis and decision making incorporating the concepts taught.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The exam consists of a written examination (duration: 120 minutes).				
7	Empfohlene Kenntnisse/Recommended knowledge: none				
8	Formale Voraussetzungen/Formal requirements: none				
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules				
10	Modulbeauftragte*/Module coordinator: Faes			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau	

11	Literatur/Literature: Recommended reading will be announced during the course.
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://ire.mb.tu-dortmund.de/studies/

Modul MB-2104: Introduction to Reliability Engineering

English module title: Introduction to Reliability Engineering						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Introduction to Reliability Engineering		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: In this lecture series, students are taught the fundamental basics of risk engineering. This course starts with a general overview of what Risk-based engineering is, and how it complements traditional safety-factor driven design calculations. To complement the remainder of the lecture, the course builds the necessary theoretical foundations of probability theory, which are explained from an engineering perspective with emphasis on mechanical engineering applications. Then, the basics of qualitative risk assessment (FMEA, FMECA, HAZOP) are explained, which form the basis of performing a risk analysis. To make the step towards more complicated systems, Fault Tree and Event Tree Analysis are discussed in detail. Also, the step towards time-dependent reliability analysis and the effects of fatigue on the mechanical reliability are discussed. Finally, to make the students aware of the challenges that are associated with dealing with real-life engineering problems, the effects of including vague, dubious, conflicting or missing information on the analysis of reliability are discussed in detail.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this course, students will be able to understand the basic concepts of reliability-oriented design and apply them to a practical engineering case. Students will be able to perform a basic risk analysis of a mechanical component or system (such as a machine), and will be able to discuss the time-dependent reliability of a component under, e.g., fatigue loads.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The exam consists of a written examination (duration: 120 minutes).					
7	Empfohlene Kenntnisse/Recommended knowledge: none					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*/r/Module coordinator: Faes			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://re.mb.tu-dortmund.de/studies/
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Modul MB-2105: Advanced Methods for Reliability Engineering

English module title: Advanced Methods for Reliability Engineering						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 2. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Advanced Methods for Reliability Engineering		V(2)+Ü(1)+P(1)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: In this lecture series, students are taught the fundamentals of "reliability-oriented design". First, the theoretical foundations of probability theory are explained from an engineering perspective, with emphasis on mechanical engineering applications. In a second step, the concepts of mechanical reliability are explained and (semi-)analytical methods are discussed to calculate the mechanical reliability of a component under mild assumptions. Since these (semi-)analytical approaches are not always tractable, advanced numerical calculation schemes are discussed in detail, including Monte Carlo simulation, Importance Sampling, Line Sampling and Subset Simulation. Finally, specialized topics such as surrogate modelling, sensitivity analysis and reliability-based design optimization are covered. The course provides students with important concepts and unique tools for designing and optimizing mechanical components with a quantified reliability.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this course, students will be able to understand the concepts of reliability-oriented design and apply them to a practical engineering case. Students will be able to implement, apply and analyze the results of advanced numerical methods for reliability-oriented design optimization and will also be able to make educated and quantified estimates of the reliability level of a designed component.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: verpflichtend/mandatory					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: mündlich/oral ☐ digital To participate in the module examination, students must complete a project assignment. As a module examination, students present the results of the project assignment in an oral examination (duration: 30 minutes).					
7	Empfohlene Kenntnisse/Recommended knowledge: Introduction to Reliability Engineering					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*/r/Module coordinator: Faes			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		

11	Literatur/Literature: Recommended reading will be announced during the course.
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance https://ire.mb.tu-dortmund.de/studies/

Modul MB-2106: Reliability of Systems and Networks

English module title: Reliability of Systems and Networks						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Reliability of Systems and Networks		V(2)+Ü(2)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: In this lecture series, students are taught how to assess the reliability of systems and networks, as well as to design these assets robustly. Systems in this context mean systems of components, as for instance present in the drivetrain of an automotive vehicle, but also electricity grids or logistic networks. The course starts with a brief description of risk analysis and its aspects in systems engineering. Then, basic concepts such as FMEA, FMECA and HAZOP are discussed. Further, students are taught how to transform a mechanical system or network into a graph representation, and how to interpret several important aspects of this graph. Based on these foundations, we further discuss Fault Trees and Event Trees, and derive quantitative measures for the reliability of the system/network, including survival signature. Finally, also more advanced methods based on Markov Chain Monte Carlo analysis will be discussed					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Upon successful completion of this course, students will be able to understand the concepts of reliability and robustness in the context of design and interpreting systems and networks. Students will learn the basics of system-based reliability analysis, including powerful tools to analyze the robustness and reliability of the network, as well as to design these.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: verpflichtend/mandatory					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: mündlich/oral ☐ digital To participate in the module examination, students must complete a project assignment. As a module examination, students present the results of the project assignment in an oral examination (duration: 30 minutes).					
7	Empfohlene Kenntnisse/Recommended knowledge: Introduction to Reliability Engineering					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*r/Module coordinator: Faes			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance Teacher: Dr. Marcos Valdebenito https://ire.mb.tu-dortmund.de/studies/
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Modul MB-9204: Scientific Project Work MMT

English module title: Scientific Project Work MMT						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe+SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester		
			LP/CP: 10,0		Aufwand/ Workload: 300 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Scientific Project Work MMT		P(4)	10,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: The Scientific Project involves a study-accompanying homework in the scope of 10 CP in a team work format. Each team member has to prepare an independent part proving their individual performance for evaluation by the examiner. Within four weeks after the submission of the homework, each student has to show the results by giving a presentation. Scientific Project Works are offered by the Department.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: By preparing a scientific project work and doing an oral presentation, students acquire the competence to do scientific work and to apply scientific knowledge as well as gain technical and method competence. Furthermore, by working in intercultural teams, students acquire teamwork skills, presentation competence, etc., which promote the social and intercultural skills, i.e. professional key skills.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☐ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital Written paper and oral presentation: Each candidate must write their own paper on the relevant topic in accordance with academic standards, demonstrating their own achievements. After the paper has been submitted, each candidate will give a presentation of their results in the form of a lecture within four weeks, during which skills such as presentation skills, rhetoric, and expressiveness will also be assessed. The oral presentation will be graded at 20 % of the overall performance. The processing time should not exceed 6 months and begins when the topic is assigned. If the processing time exceeds six months, the candidate is not entitled to further academic supervision or to submit the project work. In this case, the project work can be repeated in its entirety (without recognition of a failed attempt) with a new topic.					
7	Empfohlene Kenntnisse/Recommended knowledge:					
8	Formale Voraussetzungen/Formal requirements:					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules					
10	Modulbeauftragte*r/Module coordinator: Dekan			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		

11	Literatur/Literature: Recommended reading will be announced during the course.
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance

Modul MB-9604: Interdisciplinary Qualification

English module title: Interdisciplinary Qualification					
Studiengang/Degree program: Master Manufacturing Technology					
Turnus/Interval: WiSe+SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1./2. Semester	
			LP/CP: 10,0		Aufwand/ Workload: 300 h
1	Modulstruktur/Module structure				
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP
	1	Interdisciplinary Qualification		V(4)+Ü(4)	10,0
2	Lehrveranstaltungssprache/Language of instruction: English				
3	Lehrinhalte/Teaching content: The module „Interdisciplinary Qualification (non-technical elective course) can be offered by any academic unit of TU Dortmund University and must meet the following requirements: • The content must be non-technical. Courses from the Department of Economics cannot be taken. • The module is completed with 10 CP and may be composed of one single course or several courses of different departments. The module is therefore completed either with partial performances or a module exam.				
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Completing elective modules from other disciplines allow students to be introduced to and become familiar with methods applied in other disciplines of science. In this way, students improve their language, social, and intercultural as well as diversity skills.				
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☒ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none				
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital The type of exam depends on the elected course. The module may be completed with a single course worth 10 CP or a combination of several single courses each worth less than 10 CP. The grade of the module is calculated by using the credit point weighted average of the single courses. Even though the total CP of the single courses may be higher than 10, the module will only be counted as 10 CP.				
7	Empfohlene Kenntnisse/Recommended knowledge: None.				
8	Formale Voraussetzungen/Formal requirements: None.				
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules				
10	Modulbeauftragte*r/Module coordinator: Dekan			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau	
11	Literatur/Literature: Recommended reading will be announced during the course.				

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance
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Modul MB-9704: Laboratory Work MMT

English module title: Laboratory Work MMT						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe+SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 3. Semester		
			LP/CP: 5,0		Aufwand/ Workload: 150 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Laboratory Work MMT		P(4)	5,0	4,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: The laboratory work specifically involves experimental research work. The specific objectives are defined by the chairs where the laboratory work is performed. The laboratory work is done in groups. Before the actual laboratory work, the experiments need to be prepared. This means that students have to make sure they have an adequate knowledge of the theoretical foundations and practical implementation of the experiment. Students can choose freely the chair or chairs and discipline for their laboratory work, depending on availability. The experimental contents are provided by the individual Chairs.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: After successful completion of the course, students are able to discuss different perspectives on an engineering problem and explain their own views. Students are able to deal with the different opinion approaches of other group members during a group work phase and to give and take constructive feedback. Furthermore, students understand the methodological approaches and procedures in the context of scientific work in mechanical engineering and are able to apply them to different problems.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☒ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital The examination requirements depend on the selected laboratory work and will be announced by the instructors at the beginning of the course.					
7	Empfohlene Kenntnisse/Recommended knowledge:					
8	Formale Voraussetzungen/Formal requirements:					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules					
10	Modulbeauftragte*r/Module coordinator: Dekan			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☒ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance The limit on the number of participants or information on compulsory attendance can be found in the event announcement. Registration is mandatory and is also considered a binding declaration of participation. Failure to attend after registering will result in a failed attempt. Information on the registration process can be found on the department websites: https://mb.tu-dortmund.de/en/study/laboratory-work/
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Modul MB-9804: Topics in Manufacturing Technology

English module title: Topics in Manufacturing Technology						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe+SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 1./2. Semester		
			LP/CP: 10,0		Aufwand/ Workload: 300 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Topics in Manufacturing Technology		V(4)+Ü(4)	10,0	8,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: In the module „Topics in Manufacturing Technology“ any course offered by any department/university can be taken if the following requirements are fulfilled: • The content must be manufacturing technology. • Prior written approval of suitability of a course by the MMT Coordination is required for crediting. • The module can be composed of different courses of different universities/departments. • The module can only be completed with 5 CP or 10 CP.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: Students acquire in-depth and advanced knowledge in one or several further fields of manufacturing technology according to their individual preferences.					
5	Prüfungen/Examinations: ☒ Modulprüfung/Module examination ☒ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich oder mündlich/written or oral ☐ digital The type of exam depends on the elected course. The grade of the module is calculated by using the credit-point weighted average of the single courses. So, even though the total of the CP of the single courses may amount to more than 5 or 10, the module will only be credited with 5 CP or 10 CP, respectively.					
7	Empfohlene Kenntnisse/Recommended knowledge: none					
8	Formale Voraussetzungen/Formal requirements: none					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Elective Modules					
10	Modulbeauftragte*r/Module coordinator: Dekan			Zuständige Fakultät/Responsible department: Fakultät Maschinenbau		
11	Literatur/Literature: Recommended reading will be announced during the course.					

12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance
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Modul MB-9904: Master's Thesis MMT

English module title: Master's Thesis MMT						
Studiengang/Degree program: Master Manufacturing Technology						
Turnus/Interval: WiSe+SoSe		Dauer/Duration: 1 Semester		Studienabschnitt/ Study phase: 4. Semester		
			LP/CP: 30,0		Aufwand/ Workload: 900 h	
1	Modulstruktur/Module structure					
	Nr/No	Element/Lehrveranstaltung/course		Typ/Type	LP/CP	SWS
	1	Master's thesis, written elaboration		P(10)	24,0	10,0
	2	Master's thesis, presentation		P(2)	6,0	2,0
2	Lehrveranstaltungssprache/Language of instruction: English					
3	Lehrinhalte/Teaching content: The Master's thesis is a scientific work that concludes the master program. It aims to demonstrate that the candidate is able to solve a problem independently within a period of 24 weeks by applying scientific methods. The topic of the master thesis should be chosen close to industry and must include the subject area of manufacturing technology. The Master's thesis can be issued and supervised by any university lecturer and any post-doctoral lecturer in the subject who is active in research and teaching and belongs to the Department of Mechanical Engineering at TU Dortmund University, the Department of Mechanical Engineering at the RuhrUniversität Bochum or the Mechanical Engineering Teaching Unit of the Department of Engineering at the University of Duisburg-Essen. If the Master's thesis is to be carried out in another institution of the university or in an institution outside the university, this requires the approval of the chairperson of the examination committee.					
4	Lernziele und Kompetenzen/Learning outcomes and competencies: By completing the Master's thesis, students demonstrate their ability to perform a scientific work independently, to apply scientific knowledge, to solve engineering problems, and to perform a final oral presentation. Not only technical but also method competence shall be acquired. By preparing and performing the oral presentation, students also develop key skills in decision making, taking responsibility and having self-confidence.					
5	Prüfungen/Examinations: ☐ Modulprüfung/Module examination ☒ Teilleistungen/Partial assessment Benotung/grading: benotet/graded Studienleistung/coursework: keine/none					
6	Prüfungsformen und Leistungen/Types of examinations and performances: Prüfungsform/Type: schriftlich/written ☐ digital The examination consists of a written thesis and an oral examination with a presentation of the work carried out and the results achieved. The processing time for the written thesis is 24 weeks and begins when the topic is assigned. The written thesis should not exceed 100 pages. The oral examination usually lasts 30 minutes per candidate. The overall grade for the master's thesis is composed of the average grade of the reviews, weighted at 80 %, and the grade for the oral examination, weighted at 20 %. Further details are regulated in § 19 and § 20 of the examination regulations.					
7	Empfohlene Kenntnisse/Recommended knowledge:					
8	Formale Voraussetzungen/Formal requirements: see examination regulations § 19 (2)					
9	Modultyp und Verwendbarkeit des Moduls/Module type and applicability of the module: Compulsory Modules					

10	Modulbeauftragte*r/Module coordinator: Dekan	Zuständige Fakultät/Responsible department: Fakultät Maschinenbau
11	Literatur/Literature:	
12	Weitere Informationen/Further Information: ☐ Begrenzte Zahl der Teilnehmenden/Limited number of participants ☐ Anwesenheitspflicht/Compulsory attendance	