

Module Handbook (<https://modhb.uni-kl.de/>)

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Notes on the module handbook of the department Mechanical and Process Engineering

Die hier dargestellten veröffentlichten Studiengang-, Modul- und Kursdaten des Fachbereichs Maschinenbau und Verfahrenstechnik ersetzen die Modulbeschreibungen im KIS und wurden mit Ausnahme folgender Studiengänge am 28.10.2020 verabschiedet.

Ausnahmen:

- BSc. Bio- und Chemieingenieurwissenschaften (Stand WS 20/21): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_BSc_BCI.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_BSc_BCI.pdf)
- BEd. Lehramt Metalltechnik (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Bachelor_Lehramt_Metalltechnik.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Bachelor_Lehramt_Metalltechnik.pdf)
- MSc. Bio- und Chemieingenieurwissenschaften (Stand WS 20/21): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_Msc_BCI.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_Msc_BCI.pdf)
- MEd. Lehramt Metalltechnik Werkstoffe und Fertigung (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Werkstoffe_und_Fertigung.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Werkstoffe_und_Fertigung.pdf)
- MEd. Lehramt Metalltechnik Maschinen- und Fahrzeugtechnik (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Fahrzeugtechnik.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Fahrzeugtechnik.pdf)
- MEd. Lehramt Metalltechnik Verfahrenstechnik (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Verfahrenstechnik.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Verfahrenstechnik.pdf)

Module MV-CPE-M192-M-7

Structural Analysis and Modeling (M, 5.0 LP)

Module Identification

Module Number	Module Name	CP (Effort)
MV-CPE-M192-M-7	<i>Structural Analysis and Modeling</i>	5.0 CP (150 h)
MV-ASM-M192-M-7	<i>Structural Analysis and Modeling</i>	5.0 CP (150 h)

Hint concerning Module MV-ASM-M192-M-7:
Number in examination regulations.

Basedata

CP, Effort	5.0 CP = 150 h
Position of the semester	1 Sem. in WiSe/SuSe
Level	[7] Master (Advanced)
Language	[DE/EN] German or English as required
Module Manager	Payrebrune, Kristin de, Prof. Dr.-Ing. (PROF DEPT: MV) (/staff/294/)
Lecturers	Payrebrune, Kristin de, Prof. Dr.-Ing. (PROF DEPT: MV) (/staff/294/)
Area of study	[MV-CPE] Computational Physics in Engineering
Reference course of study	[MV-88.B78-SG] M.Sc. Production Engineering in Mechanical Engineering (/mhb/FB-MV/cos-578/)
Lifecycle-State	[NORM] Active

Notice

In the winter semester the lecture is offered in German, in the summer semester in English!

Courses

Type/SWS	Course Number	Choice in Module-Part	SL	PL	CP	Sem.
2V+2U	MV-CPE-86850-K-7 (/mhb/courses/MV-CPE-86850-K-7/)	WP	-	PL1	5.0	WiSe/SuSe

- About [**MV-CPE-86850-K-7**]: Title: "Structural Analysis and Modeling"; Presence-Time: 56 h; Self-Study: 94 h

Examination achievement PL1

- Form of examination: **written or oral examination**
- Examination Frequency: each semester
- Examination number: 11052 ("Structural Analysis and Modeling")

Oral (30-45 min.) or written (75-105 min.) examination.

Evaluation of grades

The grade of the module examination is also the module grade.

Contents

From [**MV-CPE-86850-K-7**] **Structural Analysis and Modeling** (/mhb/courses/MV-CPE-86850-K-7/):

The approach to construction analysis and modeling will be explained and demonstrated with practical examples. Contents of the lecture are furthermore:

Differences of simulation methods, approaches of material description, nonlinearities of machine elements, contact description, friction phenomena, wear mechanisms and optimization methods.

In the exercise the contents are deepened and illustrated by smaller simulations in Matlab.

Table of contents

- Fundamentals of design analysis and modeling
- Overview of numerical methods and modeling methods
- Presentation of different rheological material models
- Analysis of nonlinearities
- Contact problems
- Friction and wear problems
- Introduction to optimization

Matlab exercises for the preceding topics

Competencies / intended learning achievements

From [MV-CPE-86850-K-7] **Structural Analysis and Modeling** (/mhb/courses/MV-CPE-86850-K-7/):

With the successful conclusion of this lecture, the students are able

- to call the different steps of modelling in the correct order and to give examples
- to distinguish and compare between different simulation methods, to name advantages and disadvantages of the method and to itemize typical applications
- to distinguish basic concepts of rheological material models, to deduce the behavior of combined models and to call examples for practical applications
- to explain differences of linear and non-linear dynamical systems on the example of a linear and a Duffing-oscillator, and to describe the numerical method to describe both systems
- to explain the impact of system parameters on the oscillations of a linear systems
- to describe mechanisms of friction and transfer the knowledge to practical applications
- to explain differences of adhesion models and select an appropriate model for a practical application
- to describe mechanisms of wear and explain the wear process related to wear measurements

Literature

From [MV-CPE-86850-K-7] **Structural Analysis and Modeling** (/mhb/courses/MV-CPE-86850-K-7/):

- Bungartz, H-J.; Zimmer S.; Buchholz, M.; Pflüger, D.: Modeling and Simulation - An Application-Oriented Introduction. Springer 2014
- Czichos, H.; Habig, K-H.: Tribologie-Handbuch - Tribometrie, Tribomaterialien, Tribotechnik, Springer 2015
- Pahl, G.; W. Beitz: Engineering Design - A Systematic Approach. Springer 2007
- Popov, V.L.: Contact Mechanics and Friction, Springer 2010
- Arnell, R. D. u. a.: Tribology – Principles and Design Applications. Macmillan Ed. LTD 1991

Requirements for attendance (informal)

Required knowledge, skills and abilities from design theory or similar modules as well as:

Modules:

- [MV-TM-279-M-4] Engineering Mechanics IV (M, 4.0 LP) (/mhb/modules/MV-TM-279-M-4/)
- [MV-TM-8-M-4] Applied Mechanics II (M, 5.0 LP) (/mhb/modules/MV-TM-8-M-4/)

Requirements for attendance (formal)

None

References to Module / Module Number [MV-ASM-M192-M-7]

Module-Pool	Name
[GS-CVT-ME-E-MPOOL-6 (/mhb/modulepools/GS-CVT-ME-E-MPOOL-6/)]	Catalog Electives Mechanical Engineering
[MV-MBINFO-MPOOL-6 (/mhb/modulepools/MV-MBINFO-MPOOL-6/)]	Wahlpflichtmodule Maschinenbau mit angewandter Informatik

References to Module / Module Number [MV-CPE-M192-M-7]

Module-Pool	Name
[MV-ALL-MPOOL-6 (/mhb/modulepools/MV-ALL-MPOOL-6/)]	Wahlpflichtmodule allgemein
[MV-CE-MPOOL-6 (/mhb/modulepools/MV-CE-MPOOL-6/)]	Wahlpflichtmodule Computational Engineering
[MV-PE-MPOOL-6 (/mhb/modulepools/MV-PE-MPOOL-6/)]	Wahlpflichtmodule Produktentwicklung im Maschinenbau