Module DDM 4210 - Vibration and Acoustics 2

1	Module Number	Study Programme	Semester	Offered in	Duration	Module Type	Workload (h)	ECTS Points
	4210	DDM	2	☐WS ☒SS	1 Semester	compulsory	120	4

2	Courses	Teaching and Learning Forms	Contact Time (SWS)	Contact Time (h)	Self-Study Time (h)	Language
	a) Vibrations	Lecture	2	30	60	English
	b) NVH in Automotive Systems	Lecture	1	15		
	c) Computer-Aided Vibration Analysis	Virtual Lab	1	15		

3 **Learning Outcomes and Competences**

Once the module has been successfully completed, the students can...

Knowledge and Understanding

- Explain the basic procedure of the setup of multiple degree of freedom (MDOF) models and understand the connections to NVH behaviour of automotive systems.
- Understand and explain the calculation of MDOF modal properties and mode shapes and the modal superposition method on example of MDOF Frequency Response Functions; fundamentals of plain wave and spherical wave models in acoustics with special focus to sound intensity.

Use, Application and Generation of Knowledge

Use and Transfer

- Apply matrix calculation methods to calculate modal properties and mode shapes; apply experimental modal analysis methods; apply CAE and CAT methods on MDOF systems.
- Analyse MDOF models by computational and experimental methods; analyse sound intensity of a sound field
- Calculate MDOF models with Matlab and Finite Elements.

Scientific Innovation

- Develop concepts for the optimization of NVH behaviour of automotive components by computational and experimental modal methods.

Communication and Cooperation

- Interpret the results of modal analyses and draw admissible conclusions.
- Present results of modal analyses and discuss them.
- Communicate and cooperate within the group in order to find adequate solutions for the task at hand.

Scientific Self-Conception/ Professionalism

- Justify the solution theoretically and methodically.
- Reflect and assess one's own abilities in a group comparison.

4 **Contents**

a) Vibrations: Introduction to the basic theory of vibrations; practical application to typical structural noise and shake problems; principles of Fourier analysis and order tracking; multiple degree of freedom systems.
b) NVH In Automotive Systems: Definition of NVH; acoustic and vibration problems in vehicle systems.
c) Computer-Aided Vibration Analysis: Simulation of practical vibration problems (CAT).

5 **Participation Requirements**

Compulsory: Basic knowledge in dynamics. Mathematics: Linear differential equations. 4204 Vibrations and Acoustics 1.

Recommended: Vibrations and Acoustics 1 exam passed

6 **Examination Forms and Prerequisites for Awarding ECTS Points**

Written exam, 90 minutes, graded

Laboratory reports and tests, not graded

7 **Further use of Module**

NA

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8	**Module Manager and Full-Time Lecturer** Prof. Dr.-Ing. Joachim Berkemer
9	**Literature** Lecture Documents; Ewins, D.J.: Modal Testing. Theory and Practice. New York: John Wiley and Sons. Argyris, J.; Mlejnek, H.-P.: Computerdynamik der Tragwerke. Braunschweig, Wiesbaden: Friedr. Vieweg Verlag Further textbook references will be given in the lecture
10	**Last Updated** 02.04.2019