# Module DDM 4204 - Vibration and Acoustics 1

| 1 | Module Number | Study Programme | Semester | Offered in | Duration | Module Type | Workload (h) | ECTS Points |
|---|---|---|---|---|---|---|---|---|
| | 4204 | DDM | 1 | ☒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) Vibration and Acoustics Measurement | Lecture | 2 | 30 | 75 | English |
| | b) Vibration and Acoustics Measurement | Laboratory | 2 | 15 | | |

3 **Learning Outcomes and Competences**

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

**Knowledge and Understanding**

- Explain the basic procedure of vibrations and acoustic measurement techniques and understand the connections within theoretical basics and practical measurement.
- Describe basics of mechanical vibrations, optical, holographic and other vibrational measurement techniques.
- Basic knowledge in the mathematical, mechanical and optical fundamentals of vibrational measurement techniques.
- Recognize the significance of the subject to development process of mechanical and automotive systems.
- Understand and explain single degree of freedom (SDOF) vibrational models, digital signal processing (DSP) and fourier transform process (DFT and FFT), basics of laser light and holography.

**Use, Application and Generation of Knowledge**

*Use and Transfer*

- Apply principles of optical laws, DSP, DFT and FFT to Frequency Response Function (FRF) and Order Tracking measurements.
- Create lab reports and presentations.
- Analyse vibrational and acoustic behaviour of chosen automotive components.
- Recognize and classify connections.
- Analyse vibrational and acoustic problems and derive or develop solutions.
- Take different perspectives and points of view on a given situation, weigh them up against each other and make an assessment.
- Design components with wanted vibrational and/or acoustic properties.
- Calculate basic properties of SDOF models.
- Familiarize themselves with new ideas and topics based on their basic knowledge.

*Scientific Innovation*

- Develop concepts for the vibrational and acoustic optimization of mechanical and automotive components.

**Communication and Cooperation**

- Interpret the results of vibrational and acoustic measurements and draw admissible conclusions.
- Present FRF and operational deflection shapes 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) Vibration and Acoustics Measurement: Vibration measurement by mechanical means, optical and laser basics, vibration measurement by interferometric and holographic means, acoustic noise measurement, analysis of dynamic signals.

b) Laboratory Vibration and Acoustics Measurement: Introduction and handling of measurement equipment, FRF measurement on an automotive component, order tracking measurement on a car, Speckle interferometry, laser vibrometry.

5 **Participation Requirements**

Compulsory: Basic knowledge on fundamentals of optics and vibrations (Bachelor degree level)

Recommended: NA

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| 6 | **Examination Forms and Prerequisites for Awarding ECTS Points**<br>Written exam, 90 minutes, graded<br>Lab reports and tests, not graded |
| 7 | **Further use of Module**<br>4210 Vibrations and Acoustics 2 |
| 8 | **Module Manager and Full-Time Lecturer**<br>Responsible: Prof. Dr.-Ing. Joachim Berkemer<br>Lecturer: Prof. Dr.-Ing. Joachim Berkemer, Prof. Dr. rer. Nat. Hanno Käß, Thomas Vogt, Hans-Georg Leis |
| 9 | **Literature**<br>Lecture documents, Ewins, D.J.: Modal Testing. Theory and Practice. New York: John Wiley and Sons. Eugene Hecht: Optics, Pearson New Internat. Edition, Pedrotti: Introduction to Optics Pearson |
| 10 | **Last Updated**<br>02.04.2019 |