University *of Ljubljana*
Faculty *of Mechanical Engineering*

Technical Acoustics 5 ECTS

Lecturer: **J. Prezelj**

Lectures: 30h | Tutorials: 2h | Labs: 28h | Project: 0h | Lang. :

Objectives

The objectives of this course are to equip students with the knowledge and skills required to create physical-mathematical models for various acoustic phenomena. Students will become familiar with contemporary methods in acoustics for monitoring machinery and devices based on digital signal processing and Artificial Intelligence (AI). Throughout this course, students will learn how to perform a variety of acoustic measurements, including sound pressure level, sound intensity level, and reverberation time. These measurements are critical for analysing acoustic properties and designing solutions to mitigate noise pollution. Overall, the course aims to develop students' expertise in acoustics, preparing them to tackle complex problems related to noise control and management.

Programme

1. Gain an understanding of the physical and mathematical principles underlying the generation, propagation, and immission of sound waves.
2. Explore measuring systems for sound and digital signal processing of sound signals, including Fourier transformation and convolution techniques.
3. Learn how to extract features from acoustic signals and apply various classification algorithms to incorporate AI into acoustics.
4. Practice performing a range of essential acoustic measurements, such as sound pressure level, soun intensity vector, sound power, absorption coefficient, sound insulation, reverberation time, environmental noise, and noise at working spaces.
5. Study psychoacoustics and discover how it can be applied to product design and used in conjunctic with AI to monitor the operation of machinery and manufacturing processes through sound event classification.
6. Explore methodology for controlling noise, reducing its impact on people, and implementing noise abatement measures.
7. Develop skills for modeling sound pressure fields using the finite element method.
8. Learn how to model the propagation of traffic and industrial noise into natural and living environments.

Prerequisites

Meeting the enrolment conditions for the Master's study programme of Mechanical Engineering - Research and Development program.

Learning outcomes

Profound theoretical and practical knowledge in the field of acoustics, enabling the students to independently develop physical and/or mathematical models of acoustic phenomena, computer models, digital signal processing and the implementation of AI methods for the recognition and classification of sound events.

- Knowledge to create physical and/or mathematical models to describe acoustic phenomena.
- Knowledge and insight into a range of current acoustic methods for monitoring variety of processes and monitoring the performance of machinery and processes.
- Knowledge of digital signal processing and artificial intelligence for the implementation of methods for the recognition and classification of sound events

Assessment

- Theory – 40 %
- Coursework – 20 %
- Reporting on experiments – 20 %
- Seminar with content from laboratory exercises – 20 %

Literature

- D.R .Raichel, The science and application of Acoustics, Springer, 2000
- G. Müller, M. Möser, Handbook of Engineering Acoustics, Springer Verlag, 2013
- M. Möser, S. Zimmermann, R. Ellis, Engineering Acoustics: An Introduction to Noise Control, Springer Verlag, 2004