Chalmers University of Technology
Division of Applied Acoustics
2018-09-04

Sound and Vibration Measurement (SVM)

VTA073 1st and 2nd quarter 2018, 7.5 ECTS credits

Organisation: The organisation and content of lectures and exercises are shown in the list below. Please note that lecture attendance is compulsory! All lectures will be given in the division's teaching lab. Time and location of lab work will be announced as the course progresses.

Lecturers: Wolfgang Kropp, Jens Ahrens and other lecturers, including for each lab.

Course administrator and examiner: Jens Forssén (t: 031 772 8604, jens.forssen[å]chalmers.se).

Course literature: Lab-instructions. Measurement standards and other material are found either on e-nav (https://enav.sis.se) via a Chalmers connected computer or in the Division Library (six purple binders). Useful introduction material by B&K (Brüel & Kjær) can be downloaded from *www.bksv.com*, click *Library* and *Primers & Handbooks*.

Requirements for obtaining a passing grade, or grade 4 or 5:
- Attend the lectures
- Study the appropriate course material and lab notes prior to the lab work
- Carry out the Pre-Study (see separate document, "The Pre-Study", which explains what this means) and send to the lab assistant at least one day before the start of the lab (for all labs except lab 4)
- Actively participate in the laboratory work
- Write a report. The reports should follow our *Guidelines for Writing a Report*, which can be found on the course home page.
- The Pre-Study shall be included in the lab report (except for lab 4)
- The grading is on a quarter scale (0, 0.25, 0.5, ..., 5.5), where ≥2.5 is a passing grade, grade 4 is between 3.5 and 4.5, and grade 5 is from 4.5 and above
- For passing the course, each lab report must reach a passing grade
- The total grade on the course is the rounded average of the lab reports. (Lab 5/6 counts as two labs.)

Reports
Lab reports should be provided to the lab assistant no later than one week after the lab was made (except the last lab, which is counted as two labs and allows two weeks). One week later, the lab group will be informed by the assistant on the quality of the report and given an indication on the possible grade after improvements. A FINAL lab report is to be handed in at the latest one week thereafter. Check the web course pages for our guide to grading of lab reports.

Lab groups
The laboratory work is made in groups of four persons, the reports are written in groups of two (including the Pre-Study). This grouping is randomized for each lab. The lab assistant evaluates and suggests grades for the report.

Lectures (see common schedule for lecture times)

Quarter 1
Week 1 Lecture: Introduction. Principles of acoustic measurements. Guidelines for writing measurement reports (WK).
Week 1 Lecture: Measurement technique: microphones, loudspeakers, measurement environments (JA).
Week 2 Lecture for lab 1: Measurement of sound outdoors (GZ/CR).
Week 2 Lecture: Measurement technique: microphones, loudspeakers, measurement environments, continued (JA).
Week 2 Lecture: Report writing (JT).
Week 3 Lecture lab 2: Measurement of airborne and impact sound insulation (WK). Uncertainty estimates (JF).
Week 4 Lecture on uncertainty estimates (JF).
Week 5 Lecture lab 3: Measurement of sound power (CA).

Quarter 2
Week 2 Lecture lab 4: Signal processing (JA).
Week 4 Lecture lab 5/6: Basic vibration measurements & Vibration measurement using a laser Doppler vibrometer (JT).

Lab work
Quarter 1
Lab 1: Measurement of sound outdoors (CR)
Lab 2: Measurement of airborne and impact sound insulation (AA)
Lab 3: Measurement of sound power (CA)

Quarter 2
Lab 4: Signal processing (JA)
Lab 5/6: Basic vibration measurements & Vibration measurement using a laser Doppler vibrometer (JT)

Teachers
WK Wolfgang Kropp <wolfgang.kropp[å]chalmers.se>
JA Jens Ahrens <jens.ahrens[å]chalmers.se>
JF Jens Forssén <jens.forssen[å]chalmers.se>
GZ Georgios Zachos <georgios.zachos[å]chalmers.se>
CR Carmen Rosas <carmen.rosas[å]chalmers.se>
AA Arthur Aglat <aglat[å]student.chalmers.se>
CA Carl Andersson <carl.andersson[å]chalmers.se>
JT Jannik Theyssen <jannik@student.chalmers.se>

The course aim, as found at student.portal.chalmers.se, is as follows.

Aim

To work as an expert in noise control engineering requires the capability to design and carry out experimental work in a proper way. The course aims at giving the student insight in and understanding of acoustical measurement methods and the concepts associated with the methods. This also concerns the basics of practical signal processing.

Learning outcomes *(after completion of the course the student should be able to)*
Work experimentally in the field of sound and vibration including:

- The calibration of equipment both for air-borne and structure-borne sound measurements
- Applying standardized experimental methods, such as the determination of sound power, sound insulation, etc.
- Design of experiments fulfilling to standardization
- The application of signal processing techniques, such as FFT, correlation, etc.
- Carrying out measurement of subjective human response to sound and vibration.

Work successfully with a partner on the experimental task as team.

Develop a critical attitude to experimental approach which allow for correctly interpreting results; to critically treat, relate, and evaluate the methodology and the results.

Summarise and communicate the results in an appropriate way by reports.

Course improvements since last year
Since last year, the following changes were made to improve the course, influenced by the student evaluation work.

- Upgrading the Home-task prior to the lab into a more substantial Pre-Task, with the purpose to increase the understanding and final take-home knowledge. The Pre-Task shall explain the *Purpose*, the *Method* (Theory/Setup/Implementation) and something about the expected results and how the method is chosen to answer the *Purpose*.

    Even though the Pre-Task text is recyclable in the lab report, there is an expected added workload. Therefore, the *Uncertainty Estimates* have been cancelled from the report demands.
- Updating the lecture on report writing to include good and bad examples as well as an introduction to writing in Latex, which is not mandatory but generally appreciated by the students (eventually ;-).
- Making sure that at least one student per group is experienced in Matlab. (From last year we started to randomize the groups, which was evaluated as very positive, but now we include the boundary condition of Matlab knowledge.)
- The lab on sound insulation has been moved to be before the lab on sound power, since the former one has a lower work load and therefore is thought to fit better early in the course.
- Increasing the number of electronically available standards (via e-nav https://enav.sis.se).
- Other amendments to the lab instructions.