

ADP: Practical experience in acoustics education

Sebastian Buckert, Adam Skowronek, Kai Wolf

System Reliability and Machine Acoustics SzM, Technische Universität Darmstadt, 64289 Darmstadt, Germany, buckert@szm.tu-darmstadt.de, skowronek@szm.tu-darmstadt.de, wolf@szm.tu-darmstadt.de

Introduction

The former diploma degree program mechanical engineering had the reputation of being theoretical and not as related to practice as it was supposed to be. As the bachelor and master programs were introduced in the winter semester 2007/08 at the TU Darmstadt, the teaching had to offer more practical oriented courses. Thus, the students get the possibility to participate actively in the progress of these courses. The objective of these courses is to offer the students an insight in practical engineering problems and to prepare them for the challenges of their prospective profession.

Studying mechanical engineering at the TU Darmstadt

Every year more than 400 new students begin their bachelor program of mechanical and process engineering at the TU Darmstadt. The regular period of study is six semesters. The major fields of study are mathematics and natural sciences for engineers and the fundamentals of engineering like mechanics, thermodynamics, machine elements, computer-aided design, and material science. Moreover, the students can choose from various courses to define their individual priorities.

Registering for the master program of mechanical and process engineering requires a bachelor degree in engineering of the TU Darmstadt or an equivalent degree from another university. The duration of the master program is four semesters. The education is widely diversified in order to offer the students the possibility of working in many areas of engineering. As in the bachelor program, the students have the possibility to select their own thematic priorities. Furthermore, many courses are focused on gaining practical experience and interdisciplinary competences. To meet these requirements, the institutes of the department of mechanical engineering offer several tutorials, research seminars, and so called Advanced Design Projects (ADPs).

Advanced Design Project

An Advanced Design Project is a student project that preferably takes place at industrial sites, tasking real problems with practical relevance. A team of students works on the problem for two to four weeks depending on the complexity of the task.

The courses are organized by the institutes of the department of mechanical engineering, so that several ADPs are offered every semester and the students can choose by interest. Until the end of the master degree program, the students have to gather 12 credit points from ADPs. One ADP is rated with 4 to 12 credit points, depending on the time required to solve the given problem.

In order to appraise the students' performance, the field work is evaluated, and a report of two to three written pages per person and credit point must be handed in. Furthermore, the students have to give an oral presentation of their results.

Today it is very important that the education of students is not just focused on imparting theoretical knowledge but also includes the utilisation of this knowledge and the training of soft skills. Through this project course, the students get the chance to apply their professional knowledge and to improve their soft skills, which is not possible in common lectures. So the objective of teaching is to impart interdisciplinary skills by solving complex problems in a team. In the group, the students must share the tasks, must arbitrate between diverging positions and they realize the necessity of compromises. Moreover, a good time management and a structured organisation of the proceeding work is necessary to cope with the task within a given period of time. Furthermore, the students improve their communication and presentation skills. In addition, the participants extend their professional knowledge for example in the fields of measurement techniques, use of data acquisition, and analysis software and simulation tools.

The institute System Reliability and Machine Acoustics

The institute System Reliability and Machine Acoustics is one of 26 institutes at the department of mechanical engineering at the TU Darmstadt. It offers lectures in reliability and system reliability in engineering, endurance strength, adaptronics, machine acoustics fundamentals and machine acoustics applications. Today more than 60 students attend the lectures in machine acoustics every semester. Besides these courses the institute offers tutorials and Advanced Design Projects in regular terms.

Former Advanced Design Projects

In recent years several Advanced Design Projects were offered by the institute System Reliability and Machine Acoustics. The project courses complete the more theoretical lectures offered by the institute. The ADPs were all held in cooperation with industrial partners, which makes the project course much more interesting and motivating for the participants, as they get an insight in realistic and industrial related work. For the institutes and companies this project course has many advantages and could be the start of a cooperation. For the companies the risks and the costs are low, in addition they get useful results and solutions. The ADP may also be the starting point for bachelor and master theses or ongoing projects. In the following, an overview of the latest projects will be given.

ADP 2002: Powered glider

In 2002 the ADP was arranged in cooperation with a small aircraft manufacturer that produces gliders and powered gliders. A team of eight students had to detect the present acoustical situation of a powered glider. Based on these results, the glider was acoustically optimized and it even attained the environmental label “Blauer Engel” (Blue Angel) for silent products.

ADP 2004: Company for production technology

Two years later, a team of students supported a company that sells production technology by identifying and quantifying sound sources in the production hall. From these measurements a noise map of the production site was developed (Figure 1), and several suggestions for possible noise reduction approaches were made.

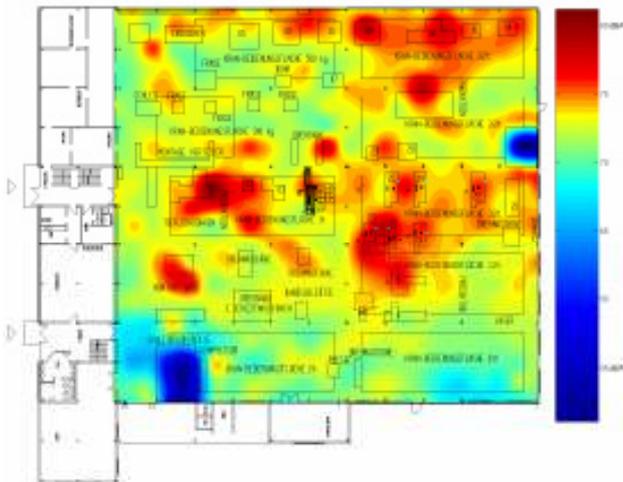


Figure 1: Noise map of a production hall

ADP 2005: Powered Glider

In the second project related to the powered glider, the participants planned and designed a test facility for silencers of powered gliders with Wankel rotary engines. With this test stand, the students checked several silencers.

ADP 2005: Aircraft manufacturer

In 2005 the students assisted a company by analyzing the sound radiation of hydraulic test stations for airfoil wings (Figure 2). The aim was to reduce the noise immission in the machine hall and the measuring station.



Figure 2: Hydraulic testing facility for airfoil wings.

ADP 2006: Aircraft manufacturer

Six students detected the sound radiation of different test stands in a machine hall and generated a noise map from the results.

ADP 2007: Manufacturer of server cases

In this project, the students analyzed the sound radiation of a server case (Figure 3). Based on the results a silencer for the fan was developed and designed (Figure 4). Furthermore, a patent application for the silencer was filed.

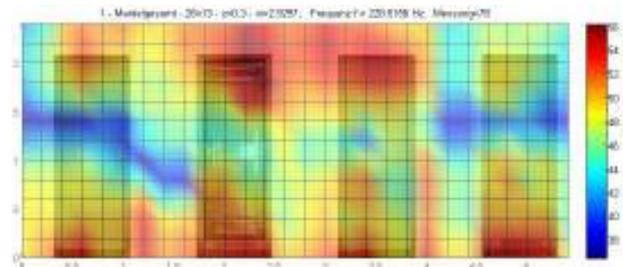


Figure 3: Noise level on the surface of the server case.

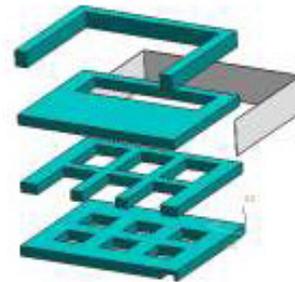


Figure 4: Silencer for the fan of the server case

ADP 2008: Producer of induction furnaces

In October 2008 the ADP took place in cooperation with a company that produces induction furnaces. The students accomplished an acoustical analysis of an induction furnace and identified possibilities for noise reduction measures.

Summary and Conclusions

The Advanced Design Project offers many advantages not only for the students, but also for the institutes offering these project courses.

The project courses ideally complete the lectures offered by the institutes. Moreover, the institute acquires important contacts to different companies, so ongoing projects may be launched. Thereupon bachelor and master theses can be offered in cooperation with these partners.

As the students work on real engineering problems they get practical experience and an insight on their prospective profession. The participants can also improve their soft skills, for example communication and presentation skills, as well as their professional knowledge.

In summary, the Advanced Design Project is advantageous for all participants.