Innovative design projects for Mechanical Engineering and Product Design students

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Summary

At Faculty of Mechanical Engineering, BUTE, “Design Project” is a regular course of both BSc and MSc training, supervised by industrial and academic partners. Training objectives are:

- To learn the industrial environment for product innovations and development,
- To integrate the knowledge of Engineering Science fundamentals, Design and manufacturing processes, Economics, environment and society,
- To develop practical skills in communication and team work.

Abstract

The machine design students, during their BSc studies, are learning the following, design related subjects: Introduction to CAD, Design Methodology, Engineering structures, CAD systems and Structural Analysis. In the MSc studies these subjects are: Design theory, CAD technology, Design of ME structures and Marketing. In the BSc period they have one, semester long design project, followed by two more projects in the MSc training. Each one is tailored for 2-4 students in order to learn the project communication and “the working in team-technologies”.

The product design students are focusing on the integrated product processes (from the market research through the conceptual solutions, to the preparation of the first prototypes). They have subjects like Integrated Product Design in every semester.

The problems to be solved are raised by companies. The university instructors select the proper ones, fitting the requirements, like 3D design of load carrying structures or torque transmission equipments, using static /dynamic/kinematics/thermal/…analysis, and considering the complexity of the problem for one semester. The industrial and academic supervising is a critical issue. The common goals and requirements are selected at first. At the same time the motivations are partly different: the industrial experts are going to follow the company’s standards in methodology, documentations, technologies etc., not known by the students. If the different approaches are balanced by both supervisors, focusing on the final product (considering cost issue, manufacturability, weight reduction, life time operation, etc.) the students are satisfied, due to the direct industrial application of their design projects.

The product design topics are suggested by design offices, and companies working on innovative products. The companies are frequently ready to prepare the prototypes or simplified physical models. The common ways of communications are 2-3 presentations, personal discussions, e-mails or videoconferences during the semesters.

The Department’s industrial relations are based on regular design assignments as well as on thesis works and degree projects. 60 to 80 companies are involved in each semester. Problems raised by companies are frequently intended to be solved in the form of design

tasks for students. In this latter case, it is important to harmonize the type and level of difficulty of a task with students' knowledge and skills acquired; in addition, problems should be possible to solve in 10 to 12 weeks. It is important that companies are required to provide regular consultations to familiarize with the technologies applied and to avoid initial misunderstandings.

Problems selected can often be classified into conceptual design or detail design tasks. In the first case, expected solutions can be outlined to a lesser degree by industrial and university supervisors, while they can be more precisely estimated in case of detail design tasks.

First steps of a design task

The task is briefly defined and then students get acquainted with the company's operations, profile, and solutions so far. Familiarization with critical remarks is followed by a discussion and documentation of requirements performed jointly by students and supervisors according to regular classifications.

It is a more difficult problem to present the role of the market in respect of a specific design task. This requires an overview of existing product solutions, their advantages, disadvantages and market status. Industrial consultants play a dominant role in this aspect.

Schedule	**1**		**3**		**5**		**7**		**9**		**11**		**13**	
Define basic design tasks	●													
Distribute design tasks	●													
Familiarize with company		●												
Produce list of requirements		●	●											
Preliminary task plan, first tasks			●											
Market environment, competition		●	●	●										
Develop first solutions				●	●	●	●							
Discuss solutions, deliver presentation						●	●							
Select solutions appearing to be successful							●	●						
Elaborate geometric details								●	●	●				
Implement correct design for manufacturing									●	●				
Optimal solution										●	●	●		
Draw up documentation												●	●	
Closing presentation													●	●

Last year the following innovative product concepts were prepared: LCD TV support, adventure scene for skiing under summer conditions, water meter in shower head, play

ground toys, LED light source design. In the frame of European Global Product Realization a bicycle infrastructure was developed by the cooperation of 5 universities.