

## USING OF CATIA V5 SOFTWARE FOR TEACHING AT FACULTY OF PRODUCTION TECHNOLOGY AND MANAGEMENT

**Natasa Naprstkova**

Jan Evangelista Purkyně University in Ústí nad Labem, Czech Republic  
naprstkova@fvmtm.ujep.cz

**Abstract.** The education of CAx applications is an important part of university education. With financial help of the Higher Education Development Fund of the Ministry of Education, Youth and Sports of the Czech Republic it was possible at the Faculty of Production Technology and Management, University of Jan Evangelista Usti nad Labem to realize the education of important software CAD/CAM/CAE representative CATIA V5. At present, therefore, the FPTM UJEP can offer to the students the education of the software, which is often used in companies engaged in production for the automotive industry. The paper describes the deployment of software to education, summarizes and outlines its potential and profits that may result from this commitment to students.

**Keywords:** CAx, CATIA education, student.

### Introduction

In industry there are created a variety of problems to be solved and for their solutions various methods and procedures exist. The role of technical education is also to show to students the instruments and to enable them to gain practical experience for solving problems in production [1]. CAx applications are one of these options, as some production challenges effectively addressed them and it is therefore important that students meet with significant representatives. In particular it is the area of CAD, CAM and CAE.

Teaching for CAD/CAM/CAE systems at technical universities is an important area of the education of students. [2; 3] By gaining experience in using the software from the areas of computer aided design, manufacturing, engineering, etc. the opportunities are increased to the students in the labour market, especially in industrial areas. This is important now that around the cities industrial zones are being made and the companies in these zones often use different software of this type. [4; 5]

One of such complex products is CATIA V5, which is used by such firms, which are often focused on the automotive industry. Near Ustí nad Labem there are also some companies that use this software. And based on these facts, FVTM decided to implement on its land the teaching of this software. For this purpose, the project was given in frame of a grant from the Higher Education Development Fund of the Ministry of Education, Youth and Sports of the Czech Republic entitled "Creation of new courses CATIA – 3D modeling and Catia - machining within the existing study program Manufacturing Technology", which was implemented in 2010.

The article describes the goals and implementation of this project, as well as CATIA product itself and its contribution to teaching students at FPTM UJEP.

### Higher Education Development Fund Project of the Ministry of Education, Youth and Sports of the Czech Republic

The aim of this project was to create new topical subjects, CATIA – 3D modeling and CATIA – machining in the frame of the study program Engineering Technology. It was planned to include the software in these subjects for education. This software will enable students to become familiar with the industry-leading software in the field of CAx applications and allow them to gain experience in its use, which surely will increase the possibilities for students in the labour market. The introduction of these objects extends the skills of the students in the current and desired area. They will also gain additional theoretical knowledge of terminology and usage of CAx software for computer aided design, manufacturing, etc.

As regards the implementation the project during 2010 was purchased from the funds allocated to 15 licenses of CATIA V5 software and teaching materials for both teachers and students (students may borrow these materials). Today the FVTM computer lab is equipped with this software, students have the opportunity to become acquainted with it and use it actively.

## CATIA V5

CATIA V5 is the software that covers a large part of today often used areas as the product life cycle, ie. that includes the design from the start to product construction, it can perform a variety of analysis, simulation and optimization, creates drawings and NC programs for the production itself. It can be implemented and applied in a wide area of industries, such as automotive or aerospace industry, production of consumer goods, production of machine tools and capital equipment for heavy engineering.

All CATIA V5 is based on three different platforms: P1, P2 and P3, which focus on specific levels according to customer's needs, but the data created in one platform can be used in the product from of the other platform.

CATIA V5 is modular and consists of several areas that the users can choose according to their needs. They are Mechanical Design, Shape Design and Styling, Product Synthesis, Equipment and System Engineering, Analysis, Machining and Infrastructure. [6; 7]

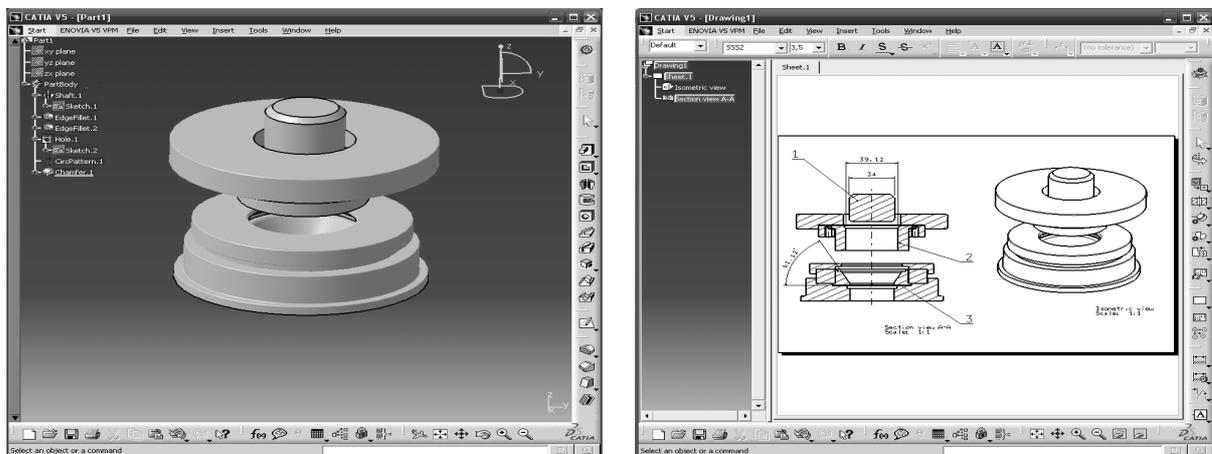


Fig. 1. Examples of working area in CATIA software [8]

## Education of CATIA at FPTM

In order to increase the skills of students at FPTM it was originally planned to implement only two subjects, telling the project name (see above), but because at FPTM in 2010 a new degree was accredited with the name Materials and technologies in transport (for a bachelor's degree) and Materials and technologies in transport (Master's degree) in both forms of study, full-time study and part-time, the above-mentioned objects were approaching the teaching as well as compulsory subjects. The bachelor's degree study was initiated in the current academic year.

Currently, students from the university have an opportunity to enroll in the current study of these subjects as optional:

- CATIA I with a 0/4 hours per week full-time and 12 hours per semester part-time study (originally scheduled match with the subject CATIA – 3-D modeling, the projected range 0/2 week)
- CATIA II with a 0/3 hours per week full-time and 12 hours per semester part-time study (another subject, which builds on the previous subject and it was not included in the project)
- CATIA - technology with a 0/3 hours per week full-time and 12 hours per semester part-time study (originally scheduled match with the subject Catia - machining, the projected range 0/2 per week).

CATIA I Course mediates to gain knowledge about 3D modeling in CATIA V5 software. The aim of this course is to introduce the most used software in the automotive industry and to prepare graduates for the automotive industry in the area of construction and design. The students get acquainted with the basics of 3D models and with the area in CATIA. They find out how to form a

sketch and what is its use. They also get acquainted with the essence of creating drawings, which is also a very important output of design and 3D model. The course includes the following points:

- CATIA – user interface, viewing and handling of objects, documents and working areas of CATIA
- Introduction to modeling - sketching and sketches (profile) - module Sketcher
- Creation of sketch-based operations, application of visual operations, etc.
- Modification of components, Part Management (concept points and Boolean operations)
- Creation of wire and surface geometry, operations with wire and surface geometries
- Creation of surface models
- Introduction to modeling assemblies – formation and assembly components, linkages between components assemblies
- Modifications to reports, part list
- Introduction to the Generative Drafting – drawing a blank, the main view, adding the perspective of the model geometry, etc
- dimensions and descriptions, making changes on the documentation, print.

Another course CATIA II enhances and complements the knowledge of 3D modeling and introduces further possibilities of using this software. The goal is to establish the subject CATIA I to deepen the knowledge of surface modeling and learning the basics of stress and strength, and kinematics simulation. The course includes the following points:

- Advanced use of Generative Shape Design
- Creation of wireframe geometry and surfaces
- Hybrid model (a combination of volume, surface and wire element)
- Modification of circuit elements
- Kinematics - basic concepts and the process of calculating
- Creation of mechanisms, kinematics pairs, the input function
- Analysis and calculation mechanism
- Cycle Design – Analysis
- Strength and stress analysis

The last course CATIA - Technology introduces the students with using CATIA applications such as CAM and the basic options in this area. Its aim is mediation knowledge about machining just using CATIA. The course contains the following elements:

- Technology modules, introduction to machining, basic concept
- Turning – basic operations, computation and path visualization
- 2.5-axis milling applications, axial (drilling, reaming, etc.) operations, computing and visualization of the tool path
- Work with machine tools and ancillary operations (rotations of workbench and tool change)
- Creation of milling features and their use for creating the NC program
- 3-axis milling applications, axial (drilling, reaming, etc.) operations
- Multi-axis machining
- Generating output (NC code, the HTML document, etc.).

The information above shows that students get quite a broad overview of the possibilities and use this application.

Another bonus is that students will be able to use this software to develop their theses (bachelor's and master's thesis), which extends them further opportunities to acquire practical skills in the applications that they can use in their future job. In making these works the students generally solve a specific problem or task directly from production companies and students will be able to demonstrate their skills also to their potential employers, dealing with something real, not just a theoretical task.

## Conclusions

From the above it is evident that after the completion of these courses, the students will gain a comprehensive view of the topic. They will learn the advantages of linking CAD and CAM software

and the acquired skills can improve their chances in the labour market, especially in the Ustí region, where unemployment is a visible problem.

The use of CAx applications allows solving problems in various areas and therefore it is important that students meet with significant representatives. The software can also be used to develop the theses.

Getting the product CATIA V5 for teaching at FVTM means further expansion of the opportunities for the students and perhaps making some of the curriculum attractive, because the students now have the opportunity to learn about the widespread and often used software in companies.

This article is due to the project of Higher Education Development Fund of the Ministry of Education, Youth and Sports of the Czech Republic No 1591/2010, the group F, specifications b.

## References

1. Müller M., Hrabě P., Chotěborský R. Optimization of surface treatment paremetrs in adhesive bonding technology. 7th International scientific conference engineering for rural development. Jelgava: LUA, 2008, pp. 214-219. ISSN 1691-3043.
2. Náprstková N., Náprstek V. Surfcam and its Education at FPTM. In 6th Internatioanl Scientific Cinfrence Engineering for Rural Development. Jelgava, 24.-25.5.2007. pp.232-235, ISSN 1691-3043
3. Náprstková N. Students connecting to production problems resolutions in CAD/CAM area. In 9th International Scientific Konfernce – Engineering for rural development 2010, pp. 310-315. Jelgava: 27.5.-28.5.2010. ISSN 1691-3043
4. Čuboňová N. Tools, Applications and Technological Possibilities of CAD/CAM Systems at Engineering Industry. Science Report Project CII-PL-0033-01-0506, Development of Mechanical Engineering as a Tool for Enterprise Logistic Progress, November 2006, pp. 95-104, ISBN 83-89873-28-1
5. Mečiarová J. Využití CA systémov při výučbe výrobných technológií. In Inovatívne postupy výučby výrobných technológií na univerzitnom stupni štúdia, zborník vedeckých príspevkov, vydaný pro príležitosti ukončenia projektu KEGA 3/5209/07, (The use of CA systems in the teaching of production technologies, In Innovative approaches to teaching manufacturing technology for university degrees, proceedings ), TU Zvolen, 2009, ISBN 978-80-228-2050-9 (In Slovak)
6. PRODUCT LIFECYCLE MANAGEMENT [online]. BEKO Engineering, spol. s r.o. , Praha. Last update 2010, [05.03.2010] Available at <http://www.catia.cz/CATIA-V5.12.0.html>
7. TECHNODAT [online]. Technodat, CAE-systémy s.r.o., Zlín. Last update 2010, [01.03.2007] Available at <http://www.technodat.cz/catia-v5>, (In Czech)
8. Šugárová J., Kováč P., Kršiaková L., Zemko P. CA systémy používané vo výučbe výrobných technológií. In Zvyšování efektívnosti vzdelávacieho procesu prostredníctvom inovačných prostriedkov, Zborník vedeckých príspevkov, vydaný při příležitosti ukončenia projektu KEGA 3/6370/08, (CA systemes used in production technologies education, In Increasing the efficiency of the educational process through innovative means, proceedings ), TU Zvolen, 2010, ISBN 978-80-228-2166-7 (In Slovak)