LEARNING TOPSOLID SOFTWARE FOR INDUSTRIAL AND EDUCATIONAL PURPOSES – A COLLABORATIVE PROGRAM DEVELOPED BY THE UNIVERSITY OF CRAIOVA AND DICO ROMANIA COMPANY

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Abstract: In these paper we present a learning program of TopSolid software and some results obtained on Computer Aided Programming of machine tools acquired by a group of students that followed an introductory course in TopSolid 2009 at the Faculty of Mechanics from Craiova and a traineeship in DiCo Romania company. This program took place outside school hours and it was attended by students who have voluntarily enrolled. After completing the program learning of TopSolid CAD and CAM modules, two students of the group, who are in the final year of study at the Faculty of Mechanics from Craiova, have applied for employment in the mentioned company. Currently, until completion of their undergraduate, they are working part time at DiCo Romania.

Keywords: TopSolid, CAD/CAM, learning

1. Introduction

Designing products that can be easily manufactured is one of the key challenges of companies nowadays. As a result, a large game of computer-aided design and computer-aided manufacturing software (CAD/CAM) was developed [7,9]. There are several types of CAD/CAM software that are listed as CAD programs. Often, capabilities differ by application [3,14,15]. TopSolid is a contemporary CAD product developed by Missler Software that offer a global and integrated general mechanical solution for both design and manufacturing [10, 11, 12, 13].

With increasing complexity of shape parts, the factories were forced to increasingly use CAD/CAM systems and in many cases they are interested in collaboration with universities to ensure its specialists in the field. DiCo Romania S.R.L. is an example of factory in which our students carry out practical internships focused mainly on computer assisted programming machine tools, using TopSolid. TopSolid’Cam is recognized today as a CAD/CAM software leader thanks to its ability to manage 2 axes milling, 3 axis milling, 4 & 5 axis continued milling, 4 & 5 axis continued turning, synchronization and complex simulation [17].

The role of the ‘typical’ university engineering program is to produce graduate engineers prepared to enter engineering practice, and to conduct, applied and fundamental research in the engineering disciplines. Because of the rapid development of certain technologies by industrial research organizations and software developers, the engineering program may find itself lagging in the integration of current engineering practice and technology. In the CAM application, details on lines and surfaces joining properly in the solid model are critical to creation of the NC code [2, 6, 16].

Engineering students rarely have the opportunity to experience the entire product realization process, from designing a product to developing a manufacturing plan for it and subsequently producing it in volume. In this conditions, a lot of courses are implemented in the engineering curriculum, with the objective to improve manufacturing engineering education by providing students with manufacturing and production experiences [1, 4, 5, 8].

In this paper are presented some results, obtained on Computer Aided Programming of machine tools, acquired by a group of students that followed an introductory course in TopSolid 2009 and a traineeship in DiCo Romania S.R.L. and in our own laboratory on a YMC 1050 machining center [18,19].
2. Manufacturing laboratory facilities used in the learning program

In order to promote production techniques on CNC machines and create an appropriate framework for their learning, at the Faculty of Mechanics from Craiova was developed an intense activity of endowment of laboratories as required.

Currently, the manufacturing laboratory of the faculty has, among others, a 3 axis machining center (fig.1), a TESA measuring arm (fig.2) and a Mitutoyo SJ201 rugozimeter (fig.3), that ensure parts fabrication and their control. Also there are available three Pentium computers and a lot of others devices and apparatus (fig.4).

3. Brief presentation of DiCo Romania company

Dico Company chain has been created as a result of association between a couple of Italian companies. Dico Romania company belongs to this network and has been created in the summer of 2004, being already operational in November, the same year.

The main activity domains of this company are: milling, electric automation panels, sales and service for cutting tools. It is foreseen that by the beginning of the next year to launch production in the mounting department, where will be made assembly units and assembly machine. Currently the company has 65 employees, and the forecast is this number will be increased to 100..120 employees by 2011. The company turnover for this year is estimated at 1.500.000 euros. The company is structured on departments and we can emphasize three of them in cutting zone: traditional machines (miller, lathes), NC machines, vertical and horizontal machining centers.
The Dico Company promotes the development of educational system in order to train youngsters using a structured approach based on practical and theoretical experience. In this respect the Dico Romania Company has decided to begin collaboration with University of Craiova by offering students with the opportunity of practical exercise in this company. Concomitantly, the University has been provided with a platform of CAD / CAM program.

By this approach, it is aimed to discover skilled students and graduates, who can contribute at enhancing and developing Dico service.

4. The learning program

In 2009, Dico Romania company from Craiova, which is specialised in manufacturing on numerical control machines, and which has old links with our faculty, proposed us a collaboration with regards to using Top Solid software in both industrial and educational purposes. Following this, in 2010, when the above mentioned company provided us with three licenses of TopSolid software, we started an optional training course in Top Solid programming.

This learning program initially started with three students who offered to voluntarily undertake this course. Subsequently, three other students (of different specializations, other than industrial engineering) were asked to participate in the program's learning CAM module and they have been accepted. Because participating students came from different specializations and they had no the same ability to use computer, we started from a level that allows everyone a proper assimilation of new information. It should also be mentioned that, due to the urgent need to introduce the TopSolid at Dico company, which need to realize at that time a variety of products, we could not make a proper publicity of this learning program.

The schedule has been established function of participant’s options.

The training involved an introductory course regarding the numeric command machine programming and presentation of some practical elements of operation on YMC 1050 machining center (fig.7), belonging to our faculty (1 week), a traineeship at Dico Romania (1 week), and the learning to use of CAD and CAM modules of TopSolid software (approx. 1 month for each).
Fig. 7 Origin setting (left) and tool length setting (right)

Fig. 8 Stock mounted on vise (left) and the stock to be put on the vise jaw (right)

Fig. 9 3D part model

Fig. 10 Checking tolerances

The learning phase of each module was completed with a test which, depending on each situation, involves the creation of the 3D model or the creation of the numerical command program for a medium complexity part. Figure 9 presents an example of 3D part model, which was the object of such test, and into the figures 8, 10, 11 and 12 are some steps taken to create the NC program.
Finally, the students have developed a representative part for manufacturing in 3 axis machining centre.

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5. Conclusions

Based on the student’s results analyze concerning the programming of machine tools with Top solid software, we can conclude:
- The TopSolid interface is friendly, easy to use and well accepted by students due to its suggestive icons;
- Although the amount of information necessary for the proper use of the TopSolid Cad and Cam modules is large compared to the time that was provided for study, each student who attended the course, proved to be able to create a 3D model and a NC programe for parts of a medium complexity;
- the final phase of the learning program, which consisted in modeling, programming and execution of a representative part for 2 axis machining, pointed out the quality of the work in group of students - dimensional and geometrical deviations of the part made by them on YMC 1050 machining center not exceeding 0,03 mm.

In terms of learning program structure and its development, we can conclude:
- the introductory course regarding the NC programming and the presentation of some practical elements of operation on YMC 1050 machining center, belonging to our faculty, provided the smoothing of student's knowledge on these issues;
- the traineeship in DiCo Romania company was essential for students to understand ISO programs for a big variety of parts, the correct interpretation of technological documents and the operation on machining centers;
- the beginning of TopSolid’Cad learning was compromised by the fact that the software was available only in demo version and this was one of the causes of the extension of this phase.

Finally, we can conclude that by this program DiCo Company had the possibility to select students who like its working style and the industrial engineering specialisation of our faculty demonstrates that it is able to produce students prepared under industrial environment requirements.
References


[10] TopSolid Quick references, Missler software


[12] Top Tool, Missler software


