STUDENTS CONNECTING TO PRODUCTION PROBLEMS RESOLUTIONS IN CAD/CAM AREA

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Abstract. At the Department of Technology and Material Engineering students solve much applied problems. These solutions promote improvement of the abilities and knowledge of the students. Problems are solved, for example, within the framework of seminary works and of course of bachelor and diploma works, where students settle very often concrete parts. The article describes some of these works and acquisitions, which can have contribution for students from the point of view of getting experience.

Keywords: CAM, CAD, 3D model, NC program, SolidWorks.

Introduction

The Department of Technology and Material Engineering is, inter alia, teaching 3D modelling in CAD, CAM and NC programming. Students in these sessions can learn the basics of using these technologies. It is obvious that in the lectures, seminars and exercises, students gain basic knowledge. This knowledge can also enhance, in particular addressing not standard, but specific practical problems. In the article two of tasks from the use of CAD/CAM technology are shown.

Creating of 3D model and NC program for medal

The first example is processing the application for the Faculty of Production Technologies and Management Medal Production. Students in this work had to prepare a proposed 3D model medal, to design the NC program with using CAM application of this generation, to design a material that is suitable for processing in school use and develop an economic analysis of production of the potential medal.

As the default information for the production of the medal the logo FPTM was used (Figure 1). To create the basic outline of the shape of a lion the BRICSCAD IntelliCAD program was used (Figure 2). In this program it is possible to create complex outlines using raster and then insert the sketches used for modelling 3D objects in another CAD application.

After inserting a bitmap logo of the faculty into the BRICSCAD it was necessary to adjust the scale so that the resulting size of the sketch matched the requirements, which means working range FCM 16 CNC machines, which is at FPTM available. For the biggest part as the outlined circle with gearing the size 94 mm was chosen, which is a sufficient size of its eventual use.

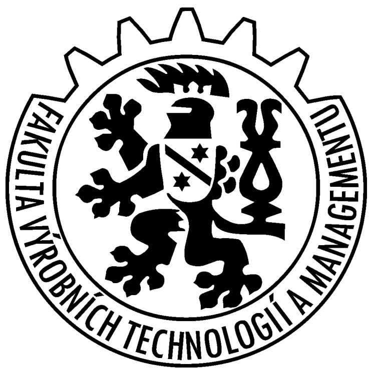

Fig. 1. **Logo of FPTM**

After this in this application there was a complete outline of a lion. The initial sketch is the result consisting of a large number of arcs and lines. All details were created, which are sharp transitions, claws, crown and mane. The text that appearing in the logo of the faculty was reduced only to the initial letters because the space reserved for the text is too small to create letters that could be produced and well cast, and would then be clearly visible and legible.

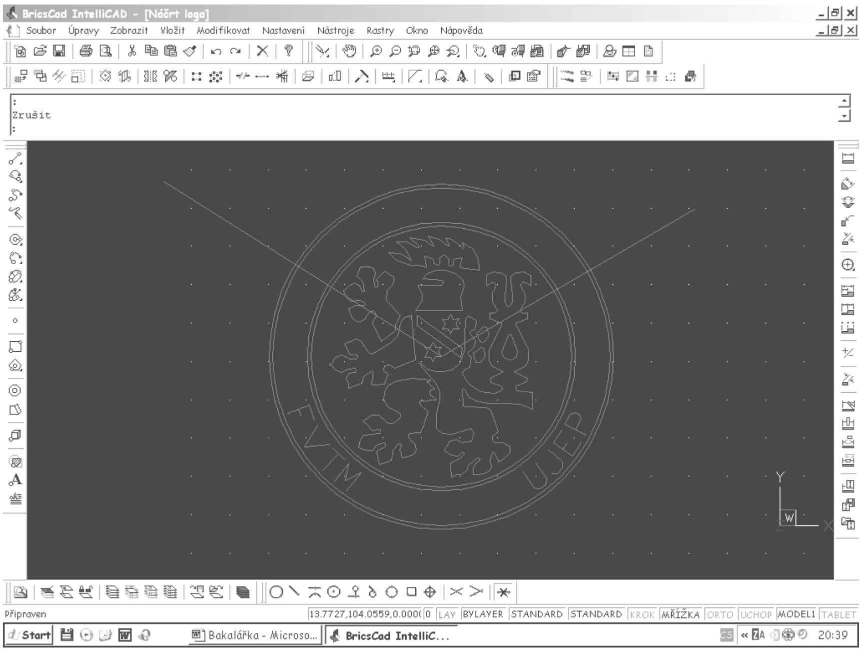

Fig. 2. **Initial sketch in Bricscad**

The medal model was then created from the sketch in Autodesk Inventor and on the basis of this model the model form was further developed, which is created as a negative model of the medal (Figure 3).

Considering the given possibilities of FPTM there was decided that the form and medals are made of easily accessible and easily machinable materials. Students had to analyze the market and select the appropriate material. FPTM has no possibility of working capacity (e.g. CNC milling machine is equipped with cooling), and metal casting, and since the project could also be used for educational purposes, it would not be safe for students. Therefore, the polyurethane was chosen as the material for manufacturing of the form (the so-called artificial wood, which is easily machinable and has good dimensional stability) and the casting resin plaques, which are best suited for production.

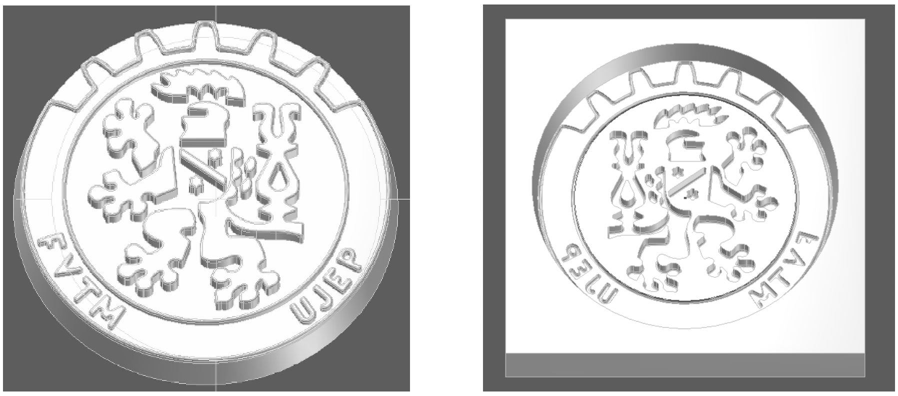

Fig. 3. **Resulting model of medal and form**

Students chose resin, the curing process does not last too long and the individual components can be easily connected. These are Technovit 4071 and Araldit GY 764 BD + hardener HY 5138.

Subsequently, a student had to prepare the technological process for manufacturing of the form for the selected material and process model in the CAM application (Figure 4) for the school production CNC milling machine (processing of form machining technology) and the technological process for production of casting the medal.

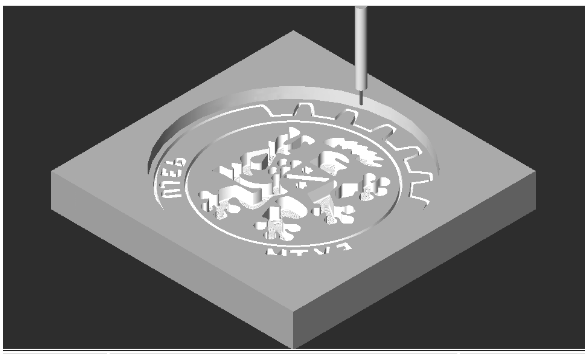

Fig. 4. **Simulation of the final machining of the mould in SURFCAM**

There was a change of the manufacturing process of the medal in the result. It was a reason of the changes options at FPTM. The device was taken to Rapid Prototyping. Its use in solving this task has proved more effective. First, the model was made by RP medal from the original model without modifications. Its showed in terms of forming and subsequent casting in metal as slightly problematic, and the student on a model made only small adjustments to the required technology, moulding the model and its subsequent casting. The RP model was designed, which was already in a good condition (Figure 5) and according to this the finished casting medal was done (Figure 6).

Fig. 5. **The resulting model created with RP**

a) b)

Fig. 6. **The finished casting unmodified (a) and a medal after coating (b)**

Finished castings, which were produced using the model of RP, were later distributed during the festival occasion of the FVTM.

Creating of 3D model and NC program for production of the concrete part

Another example of solving a particular task is the creation of 3D model of a crystallizer NC program for one company. Starting the work the task was to convert original paper documents with poor crystallizer into electronic form and create 3D models of its individual parts in such form that next time it is possible simply to modify the application , or transfer to the third party systems and of course also simply re-print. This means to make the most generally applicable standards for storage.

The reason for solving this task is the outdated, unreadable and difficult to modifiable documentation burdened uncoordinated changes, which have been difficult to continue to use in future communications with the external part of the manufacturer.

To convert the paper documents into electronic form the CAD application was used with the name SolidWorks Office Premium 2007. Figure 7 is the resulting set of 3D model of crystallizer and Figure 8 is a display of drawings that were created on the basis of the established 3D model.

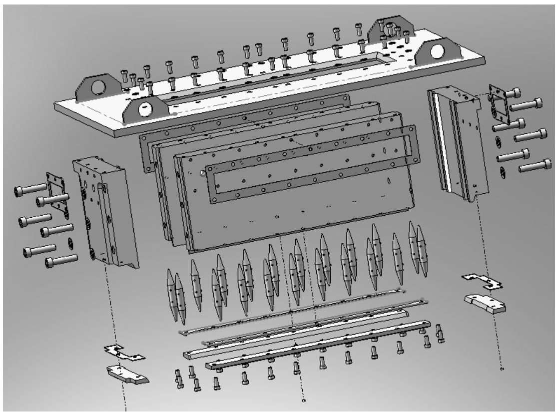

Fig. 7. **3D graphics model spread crystallizer**

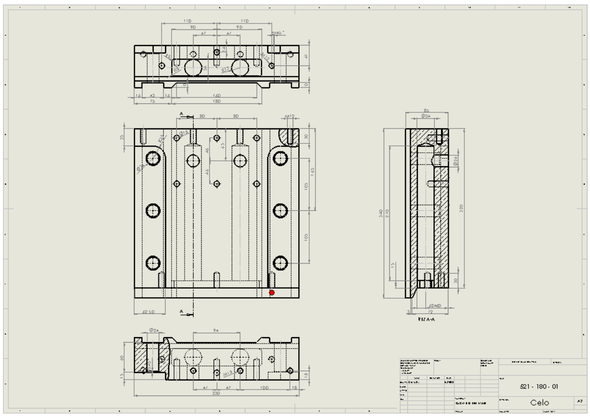

Fig. 8. **Production drawing of front crystallizer**

After creating the 3D model the student created for the selected components the technology using EdgeCAM. Figure 9 is the result of simulation of machining of one selected component crystallizer.

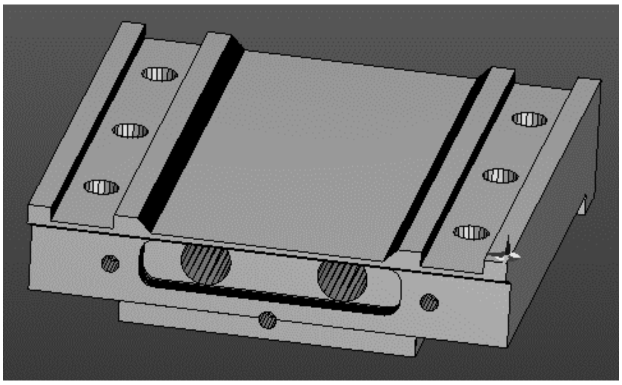

Fig. 9. **Simulation of machining the back of the head of crystallizer**

It is therefore possible to say that by the transfer to the electronic form and the creation of models, drawings and reports, the documentation got the ability to adapt to future requirements and adjustments, also during this process, particularly in the production model kits, the small gap between functional dimensions of some of the connected components, which were based on the original paperwork were identified and removed.

Conclusions

1. In the first case (3D model creating and NC program for the production of medals) the work was performed by the Faculty of Production Technology and Management. The aim of the work was to create a design of 3D model form for casting medals, including production processes and the production technology in SURFCAM CAM application. The results of this work can also serve as a teaching material for students to exercise in subjects related to programming production machinery, technical material or as a filling or teaching workshops. The solution of this work showed the students the links of CAD / CAM systems and its usefulness.
2. To resolve the problem the students had an opportunity to experience the depth of CAD application BRICSCAD and Autodesk Inventor and SURFCAM CAM application. Further experience gained in the solving work was getting familiar with new materials that can be used to create models. Materials that were ultimately chosen were also very suitable for teaching

purposes. In addition, the students got their first experience with enquiry management in real environment. As a result, the students can try out the complexity of interconnection and the use of CAD/CAM applications, obtain information and experience on their compatibility and mutual benefit.

3. In the second case (creating 3D models and NC crystallizer) the solution work also allowed for the students to get more familiar with CAD / CAM applications, in this case with SolidWorks and EdgeCAM. The students gained deeper experience in creating 3D model components, assemblies and the method of making the adjustments to the projection unit, as they tried processing and printing drawings. It was beneficial for them to become familiar with the problems of design, editing 3D models and addressing a real problem in terms of engineering practice.

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