

THE EXAMPLES OF CAD/CAM SYSTEMS UTILIZATION IN EDUCATION AND PRACTICE

Nadežda ČUBOŇOVÁ

University of Žilina, Faculty of Mechanical Engineering, Department of Measurement and Automation, Veľký diel, 010 26 Žilina, Slovakia

Abstract: At present time CAD/CAM systems have a dominant position in the air, automobile and space industry primarily. The article describes utilization of CAD/CAM system Pro/ENGINEER in education at faculty of Mechanical Engineering, University of Žilina and cooperation of Department of Measurement and Automation with Mechanical Engineering.

Key words: CAD/CAM system, computer aided, Pro/ENGINEER, NC machine, CL Data, postprocessor

1. INTRODUCTION

Computer aided programming of CNC machines is gradually being replaced by computer – aided manufacturing programs that can generate the NC program directly from a CAD file. Modern “open architecture” CNC systems, based on industrial personal computer (PC) structures prefer programming and operation in the CAD/CAM mode. CAD/CAM is concerned with the engineering functions in both design and manufacturing. Product design, engineering analysis, and documentation of the design represent engineering activities in design. Process planning, NC part programming, and other activities associated with CAM represent engineering activities in manufacturing. The CAD/CAM systems developed during the 1970s and early 1980s were designed primarily to address these types of engineering problems. [3]. In CAD/CAM system the profile of part aren't described manually with using of geometric commands of competent programming language, but it is represented by fixed spatial model that is made in CAD/CAM editor. To this geometric definition of part are attached technological parameters that are needed for tool path generating. The output from these systems can be the NC program for concrete NC machine type, or CL Data that need the postprocessor arrangement to the concrete NC program format for applied machine. The CAD/CAM systems advantage is the simulation of machining processes out of the machine. Several CAD/CAM systems from various firms are at the market nowadays. They differ from degree of integration, technical equipment and last but not least the price of the system. The main representative of present CAD/CAM system are - Pro/ENGINEER, Catia, I-DEAS,

UNIGRAPHICS, and Euclid 3 etc. The utilization of CAD/CAM systems is highly effectiveness, because it enables to reduce the process development time and the introduction of a new product in the market heavily [4].

2. CAD/CAM SYSTEM Pro/ENGINEER

Pro/ENGINEER is full parameter 3D graphic CAD/CAM system, determined mainly for general manufacture engineering and for automation of design engineering. System covered the whole processes from preliminary design, through drawing documentation to programs for manufacturing of designed parts on numerical control machine tools. With graphical system Pro/ENGINEER is possible to create fully, unambiguous and accurately space model of solid body - simply and quickly. Pro/ENGINEER contains about 35 modules that directed for individual applications (Pro/NC – fig.1, Pro/NC-Check, Pro/ Moldesign etc.). The substance of system, basic model Pro/ENGINEER can be used independent or in combination with another models according to users requirement.



Fig.1 Modul Pro/NC- extending the functionality of Pro/ENGINEER to manufacturing – Mill, Turn, Wire EDM, Sheetmetal[7]

2.1 Application of CAD/CAM System Pro/ENGINEER in Education

CAD/CAM system Pro/ENGINEER is used at Faculty of Mechanical Engineering University of Žilina, the Department of Measurement and Automation mainly for education of the objects aim at technical preparation of manufacturing.

At department was solved the problem of CL data arrangement from CAD/CAM system Pro/ENGINEER to the format of NC program that enters to the EMCO-MAIER training machines (lathe-EMCO-Compact 5CNC, milling machine-EMCO. The computer programs that have been developed read the commands of CL data from the text file by the line row and adds for every command the competent function of machine control system. The cycle of

arrangement runs till the end of the CL data files. The procedure of the manufacturing process creation in Pro/ENGINEER is shown at fig.2.

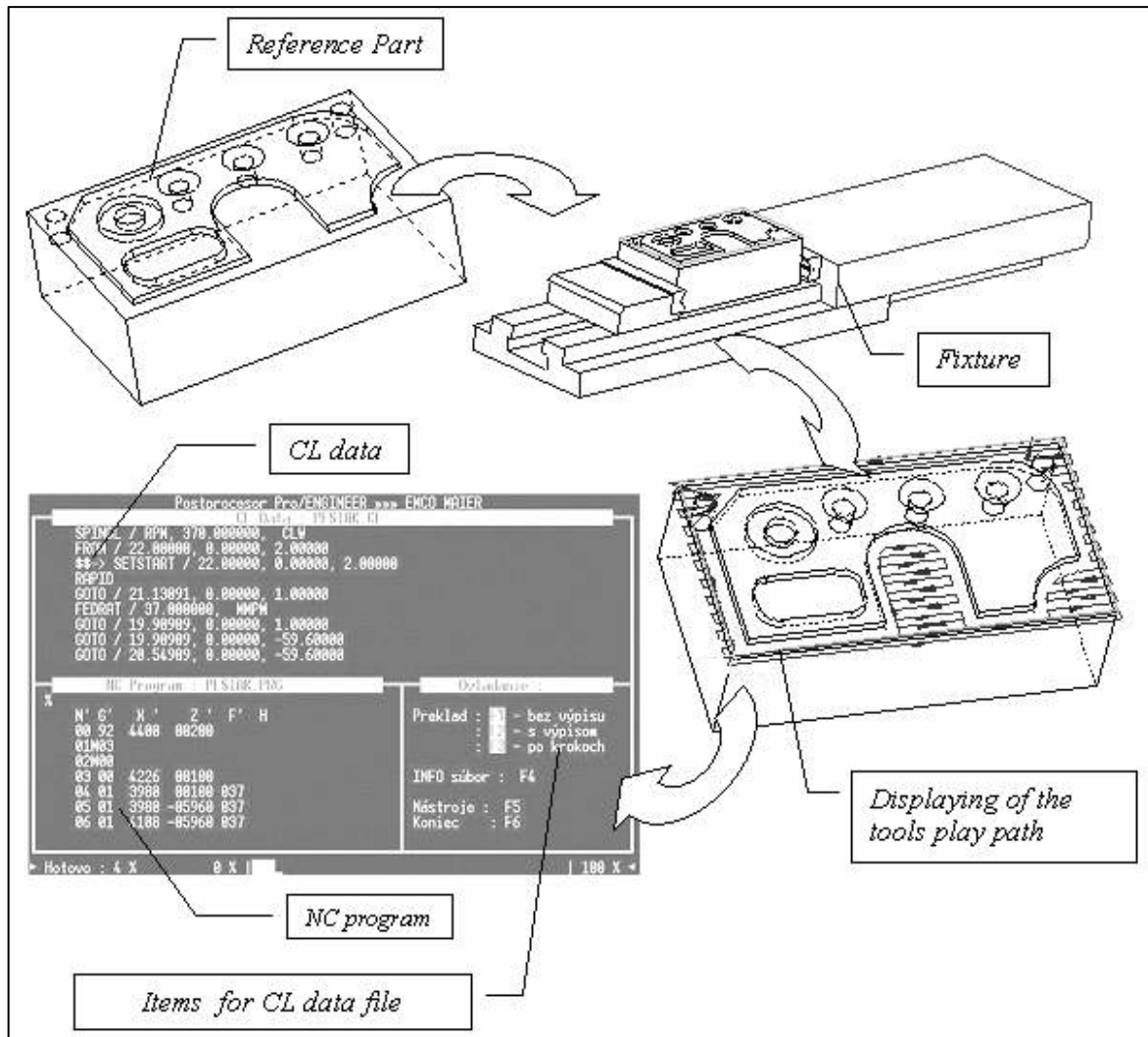


Fig.2 . The procedure of the manufacturing process creation in Pro/ENGINEER

3. THE EXAMPLES OF CAD/CAM SYSTEM PRO/ENGINEER UTILIZATION IN INDUSTRY PLANTS

Our Department had cooperation with some mechanical engineering plants that use system Pro/ENGINEER in their technological preparation of production. In frame of this cooperation the Department participate on solving some problems from the area of the CAD/CAM system utilization.

The first task from the practice in CAD/CAM system was solved on the basis of the requirements MATADOR MACHINERY, a.s. Púchov firm. Plants decided to use a new technology for the production of mould, which are used for pneumatic tyre mould. The result of this cooperation was proposal of the new technology. The operation sequences of this technology made in Pro/ENGINEER are showed at fig.3. The production of segments

becomes shorter, economically favourable, more precision and complies to the to the quality product requirements[2].










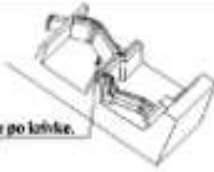


Operácia č.1.	Operácia č.2.	Operácia č.3.
		
Operácia č.4.	Operácia č.5.	Operácia č.6.
		
Operácia č.7.	Operácia č.8.	Operácia č.9.
		
Operácia č.10.	Operácia č.11.	Operácia č.12.
		

Fig.3 The operation sequences for manufacturing of mould segment

Another cooperation by the solving tasks for using CAD/ CAM system Pro/ENGINEER in practice was a proposal of the manufacturing process for the insertion piece (fig.4.a, b) into extrusion machine. The task was solved for plant KONŠTRUKTA – Industry a.s. Trenčín. The solving of the task required the proposal of postprocessor verification for a milling machine DECKEL MAHO MH 700. Developed NC program was transformed to the machine control system and the final verification of the postprocessor was verifying step by step by the manufacturing of insertion piece[1].

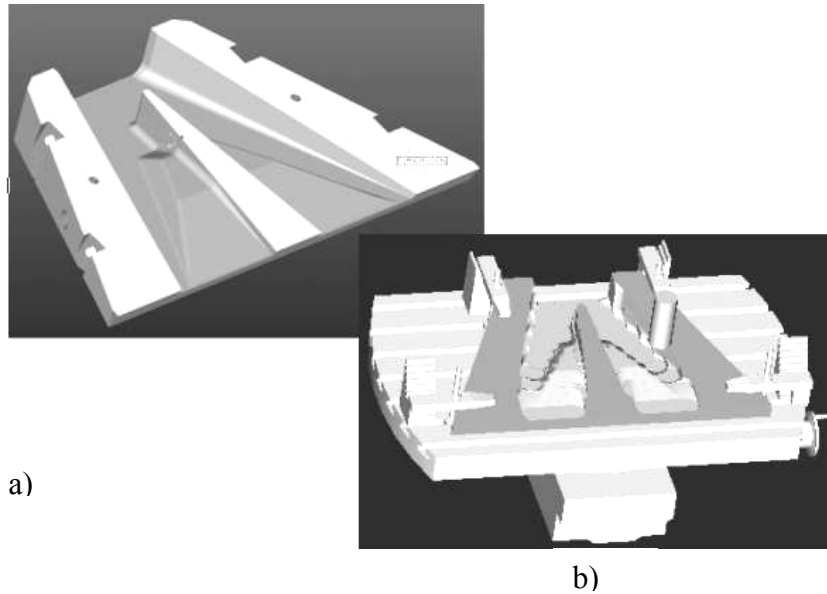


Fig.4 a) The insertion piece using in extrusion machine

b) Fixture and piece for manufacturing process modelling in environment of CAD/CAM system Pro/ENGINEER

CAD/CAM system Pro/ENGINEER is used in firm KDR, s.r.o., Žilina. Our Department solved for this firm proposal of manufacturing process for flange TS 200 AZ1.

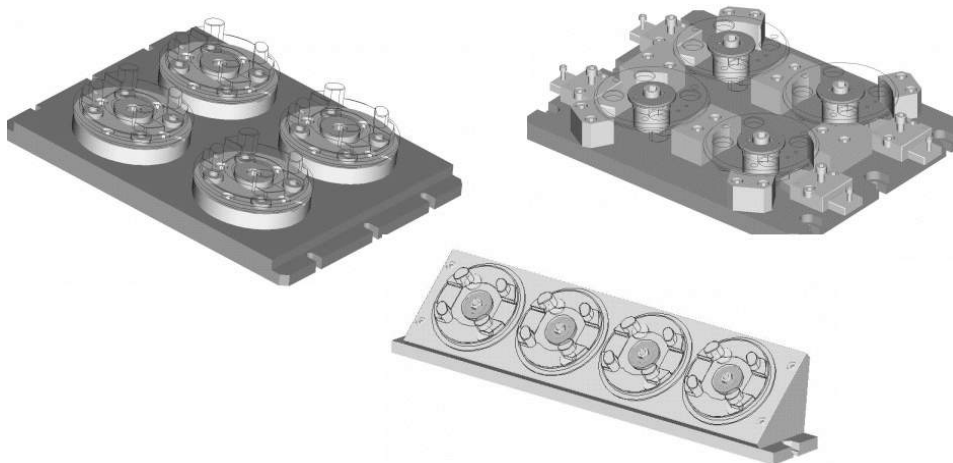


Fig.6 Design of fixtures proposal

The main problem at the solving of this task was to propose new fixtures for manufacturing of flange (fig.6), suitable tool and technological parameters, decreasing of cutting time. The simulation of created manufacturing process of flange in CAD/CAM system Pro/ENGINEER allowed us to display all critical places of the manufacturing process, the collision of the tool with the workpiece or fixtures.

4. CONCLUSION

At present CAD/ CAM systems have a dominant position in the air, automobile and space industry primarily. They enable to realise the new product development (including its optimalization) without its physical model. The effective utilization of CAD/CAM systems expressively contributes to the product life cycle shortening. The new trend is to design of the new products by "paperless design" method - it is without any paper documentation. The next effort is to unify the exchangeable formats of data files but the use shows that the utilization of the same CAD/CAM system during the whole new product development is the best guarantee of the non-problem data transfer[1].

The participation the Department of Measurement and Automation at the development of proposal new products, new technology or design fixtures and parts from practice give the possibilities for improvement of theoretical knowledge in practice.

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