15th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2011, Prague, Czech Republic, 12-18 September 2011

DESIGN OF COMPLEX PART IN CAD - CAE - CAM SYSTEMS USING OBJECT ORIENTED METHOD

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ABSTRACT
The possibility of improvement CAD - CAE - CAM systems using the application based on object oriented method paper is shown in this paper. The application is linked to the CAD-CAE-CAM systems using the API commands. The application will enable generation and modification of typical complex parts. Process planning for the complex part is done in CAM system where the G-code is generated for 5-axis milling machine and also simulation is done.
Keywords: CAD, CAE, CAM, 5 axis machine, database, object oriented method

1. INTRODUCTION
With advances in technology over the last century there was a need for creating more and more complex parts. Such a complex surfaces with irregular geometry are mostly required in the aerospace and automotive industry, turbines and propellers, and the industry tools and mold. Initially, such a complex parts successfully made using the 3-axial machines using tools with a rounded top [1]. However, as demands grew, a 3-axial machines increasingly difficult to satisfy the above requirements, the production had gradually begun to introduce and multiaxial machines, especially those with five simultaneous axes or 5-axis machines. Such machines, in most cases, beside the three translational axes possess two rotary axes. Using this kind of machines it is possible to position the tool at any point and of machined surfaces in just one clamp. It is important to note that the introduction of five axial machines in process would not represent a big step forward if its programming is not accompanied by equally rapid development of CAD / CAE / CAM systems. Regardless of the great features of CAD / CAE / CAM systems have limitations in terms of a database of non-standard elements. Using the API commands, this problem can be overcome with the integration of software with external database.

2. INTEGRATION OF CAD-CAM SYSTEMS
Right solutions are optimal solutions that satisfy the requirement a minimum price-the maximum quality. Product design is a critical activity of the manufacturing process, because it is estimated that its share of 70% to 80% of the cost of development and production [1]. With the advent of CAD systems, each designer has built for itself a database of parts, components and products, which was irrational and inefficient. To overcome this problem, manufacturers of CAD systems are involved and the process of building a database of standard elements. However, the problem of building a database of non-standard machine element still remained unsolved. This paper presents a method of creating

external database of complex structural elements. The goal was to get an intelligent CAD-CAE-CAM system through the integration of CAD-CAE-CAM system and developed a database [2].

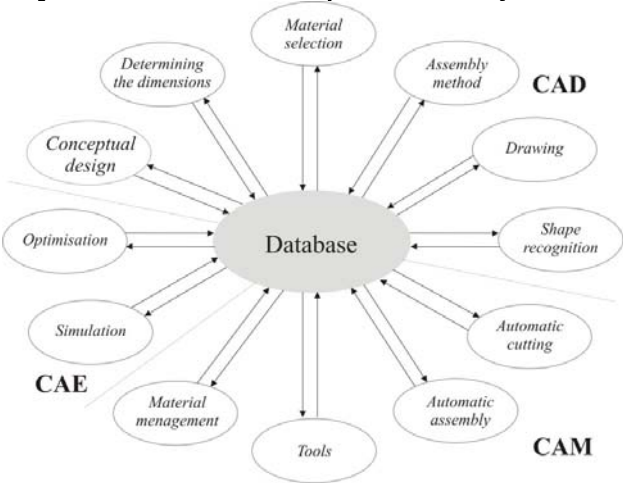

Figure 1. Integration of CAD-CAE-CAM systems through database

Figure 1 shows the integration of CAD/CAE/CAM through a shared database. Where the geometric and technological data required for programming is not created in the programming system (language), but taken from the CAD system then being used for operation and programming process. Acceptance and use of CAD data on the work piece, which include [3].

- basic data
- geometry information (elements)
- Technological elements

All data and information on the construction of the machined parts are created and stored in a CAD system. Thus created and stored data from the database can be invoked and used for programming with the use of additional software for programming. In fact there are two possible approaches to interactive programming of machining processes. In the first approach to programming is done on CAD graphics workstation where CAD system is expanded with additional programming software. In the second approach specialized CNC programming workstations using structural data of CAD/CAM database for programming. Figure 2 shows the form of the software integrated in the CAD environment.

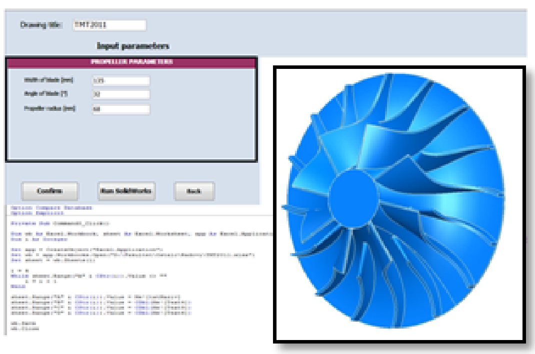

Figure 2. Object oriented programmed application

2.1. Data exchange in CAD/CAE/CAM systems

Principally exchanging data between different CAD / CAE / CAM systems can be solved in three ways:

- Ensuring the same CAD data exchange system,
- Mutual conversion of data between different CAD systems,
- Exchange of data, using a neutral model for the exchange.

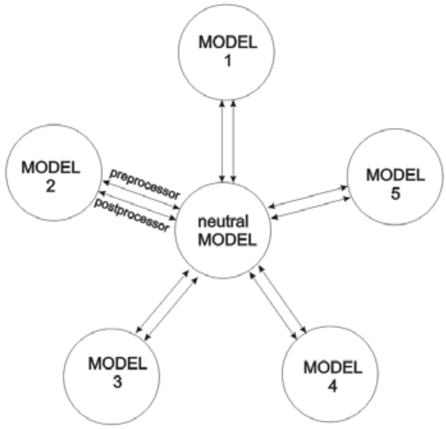

Figure 3. Exchange of CAD files using a neutral model

The best results are achieved in the first case, when all participants have the same CAD system. But even this method of transmission is not without difficulties. It is difficult to ensure that all participants have the same version of the CAD system (as a rule, provides a smooth transfer from a previous to newer versions). Beside that, the creation and use of various libraries of symbols, letters, lines and hatches also hamper data exchange. Finally, it is difficult to provide in a large corporation that all CAD systems the same, in the case of business cooperation in the development and manufacture of complex products, when a large number of suppliers of different size and business orientation have been engaged, it is impossible. Exchange of data by conversion proves a god adoption of some CAD systems, with little loss of content and distortions in the data interpretation. Neutral model of exchange is a solution that is almost exclusively used. This concept is based on the principle that each CAD system has a software solution that internal computer model of the product is reflected in the model (file) for the exchange. Another CAD system, in which they want to convey this information, it must have implemented software that loads and translates the model for the exchange in its internal computer model of the product shown in Figure 3

2.2. STEP standard

STEP is a comprehensive ISO standard (ISO 10303) for the exchange of product data model that describes how it is necessary to introduce and exchange of digital information products. STEP was created 1983rd year and is based on previous knowledge of national standards for exchanging data such as IGES, VDAFS, SET and CAD* I. STEP has taken the basic architecture of PDEs standards, EXPRESS language and functioning at three levels:

1. *application level*, which covers specific areas of application and gives the opportunity to choose those elements of STEP, which are interesting for a certain area, but also new additions to the elements, which are not covered by the STEP standard (leaving the user the ability to define its own application protocol),

2. *logical level* at which the product data (macro and micro-geometry, material properties and state, tolerance,...) transformed into a formal (information) model-EXPRESS

specification. This description consists of one or more schemes, which include entities with attributes, rules and restrictions, presented by relevant data types.

3. *physical (Implementation) level*, which defines the physical filesand file formats

3. CAM – 5 AXIS MACHINING

Application of 5 axis machining has brought significant advantages in production. But still the constant improvements in the construction of machinery permanently eliminate existing deficiencies. In large surfaces with a large radius of curvature (such as molds for the hull), the processing time can be reduced by 20-30%.

When the parts of small size and large radius of curvature is machined cutters ball end are often used [4]. The five axial milling systems can be tilted relative to the machined surface at the optimum angle so that it gets a constant cross-section resulting in favourable machining conditions at the contact point. In this way we get better quality surface finish, with the proviso that the lifetime of cutting tools can significantly prolong as it is shown in Figure 3

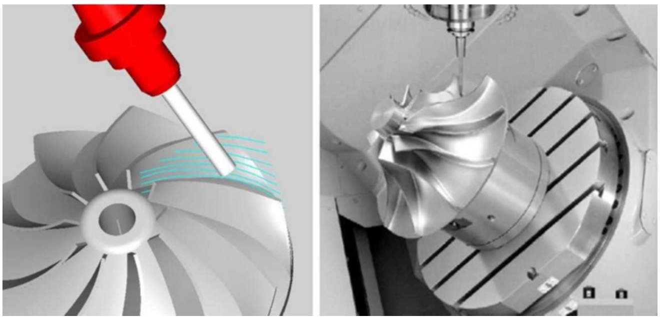

Figure 4 Simulation of CAM process and 5 axis machine control

4. CONLUSION

The software for storing and integrating the data of coplex parts into a CAD system is presented in this paper. Thus created and stored data from the database can be invoked and used when designing a complex part variant. 5 axis machining used in the CAM system is integrated with the CAD system through a shared database. In the paper shown object oriented programming through API commands. Integration of CAD/CAE/CAM systems through a common database for a complex part results in reducing development time and manufacturing products.

5. REFERENCES

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