THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XIV MECHANICAL ENGINEERING, ISSN 1224-5615
2009

COMPARATIVE STUDY BETWEEN THE COMPUTERIZED DESIGN AND THE CLASSICAL ONE

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ABSTRACT

Through this paper the author demonstrates the indisputable advantages of parameter assigned design which through its own features provides the possibility of automatically obtaining technical drawings including the catalogue axonometric representations, which are commonly known to be time-consuming. The stages of carrying out a parameter assigned project are also presented, as well as the manner of obtaining the execution drawings, respectively the exploded representation of the ensemble, ending by highlighting the most important advantages of parameter assigned design.

KEYWORDS: CAD/CAE, Siemens, Solid Edge

1. Theoretical Background

Computer Aided Design (CAD) is increasingly used in various fields such as mechanical engineering, architecture or product design, being a rapidly developing field. The modern CAD programs are no longer limited only to simple drawing systems using computer facilities followed by positioning some sizes and shadows, but have evolved by adding features and new 3D modelling instruments, featuring the ability to create solid geometric patterns and surfaces based on the parameters indicated by the project engineer.

The traditional design makes use of lines, circles or other 2D geometric primitives to draw. Often, the connection between the real shape and the designer's vision can be interpreted only by an engineer. The real qualitative leap is made when creating intelligent 3D models, which is, in fact, the computer aided design. Working in 3D opens a multitude of possibilities that facilitate both the designer's work and the beneficiary project perception. Making automatic axonometric representations of cross sections, details, views and animations are some of the new working tools.

Preserving links between the 3D model and 2D plan-changes made in one place are automatically reflected throughout the project - represents a huge advantage for the designer, his work being much simplified. Creating orthogonal projections often requires a large number of hours spent in various manual operations to complete projects. Solid Edge is an easily usable design for the mechanical design applications due both to the automation of various common operations and the predefined libraries with machine elements, which lead to increased productivity because time is no longer consumed with their physical achievement.

2. Criteria for Study and Analysis

In the classical design the engineer is working on his drawing board using simple tools such as pencil, ruler, and calculator without having the possibility to quickly reuse his achievements in another project. With CAD there are two ways of working:

- Computer-aided drawing that allows for easy changes as regards rapid removal of projections, deletion of geometric elements, quick quotation but is unable to impose a numerical value on the actual length of the item quoted.
- Computer-aided design, which, unlike computer - aided drawing, is much more laborious, but allows for the generation of much more spectacular results, such as:
  - Obtaining parameterized drafts when a change in size leads to changing the draft geometry

- The drafts obtained meet a set of geometric restrictions, in the sense that certain primary geometric elements: line, circle, arc will be permanently on the vertical / horizontal, equal, symmetrical, tangent at the neighbouring element as imposed by 2D restriction
- Obtaining families of parts by defining variables in excel files, which allows to automatically obtain several projects starting from one
- Automatic achievement of the execution drawings (Figure 1) which are in univocal or biunivocal correspondence with a three-dimensional model, ie, changing the solid will automatically change the drawing and, in some design programs, modifying the execution drawing involves changing the designed solid
- The three-dimensional assembly is achieved by external references, in the sense that they bring in the assembly file the 3D items that are placed in the previously achieved files, relative 3D positioning restrictions are imposed and finally, if it is necessary to amend a file related to a particular item, this change is automatically found in the assembly project (Figure 2)
- Getting scenes having the assembly exploded, the possibility of applying the material properties on the item level, such as transparency of colored glass applied to housings, which allows viewing all the interior components (Figure 3)
- Automatic design of the overall drawing table with component parts table and positioning of all items
- The possibility of verifying every item by the finite elements method and rapidly making changes, if any, and, finally, subjecting the result to a new analysis
- Possibility to verify, by specific commands, the proper functioning of the mechanism designed.
- The existence of complex commands performing engineering strength calculations or able to insert in the project elements standardized machine elements.
- Limitless possibilities of communication and transfer, archiving, mail-transmission , use of numerical control machine tools.

Since all these advantages are not found in the classical design it is obvious the superiority of the to computer-assisted design over the traditional one in relation both in terms of productivity and economic efficiency. When designers produce drawings for mechanical projects using general soft wares, drawing errors can occur whose correction does not involve additional costs and time.

The present study referred to the Solid Edge v. 20 which provides support for the local and international design standards and includes a huge library of standard elements, allowing users to make accurate drawings in a very short time.

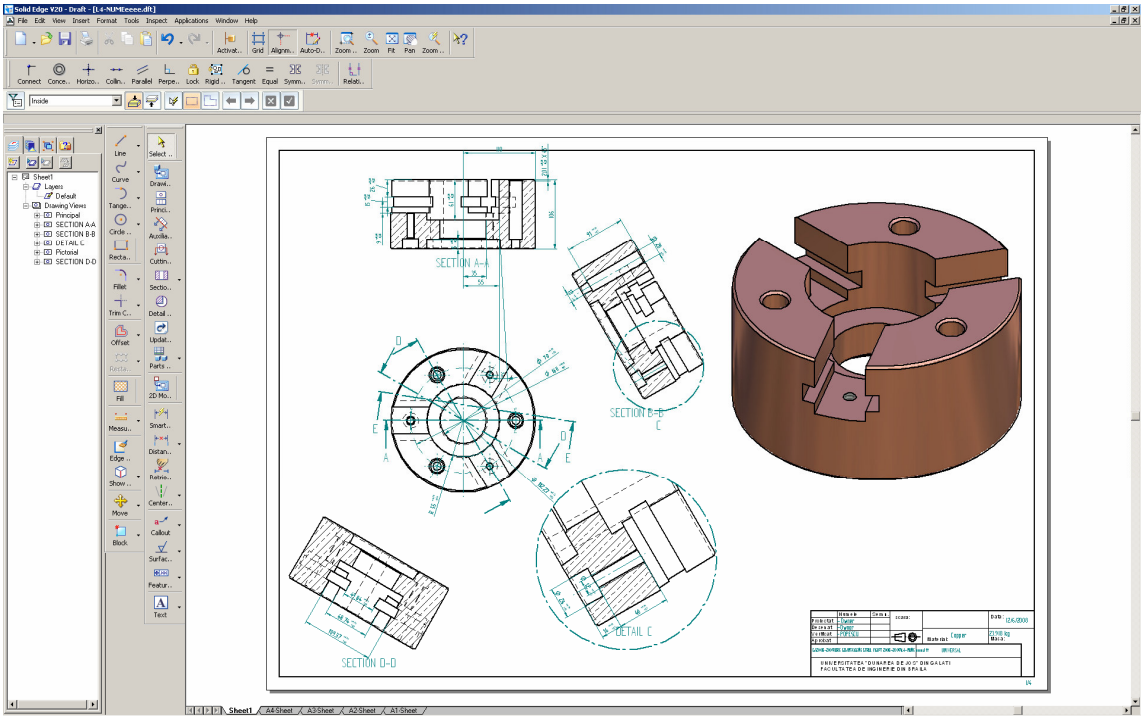

Figure 1. The execution drawing automatically obtained for the designed item

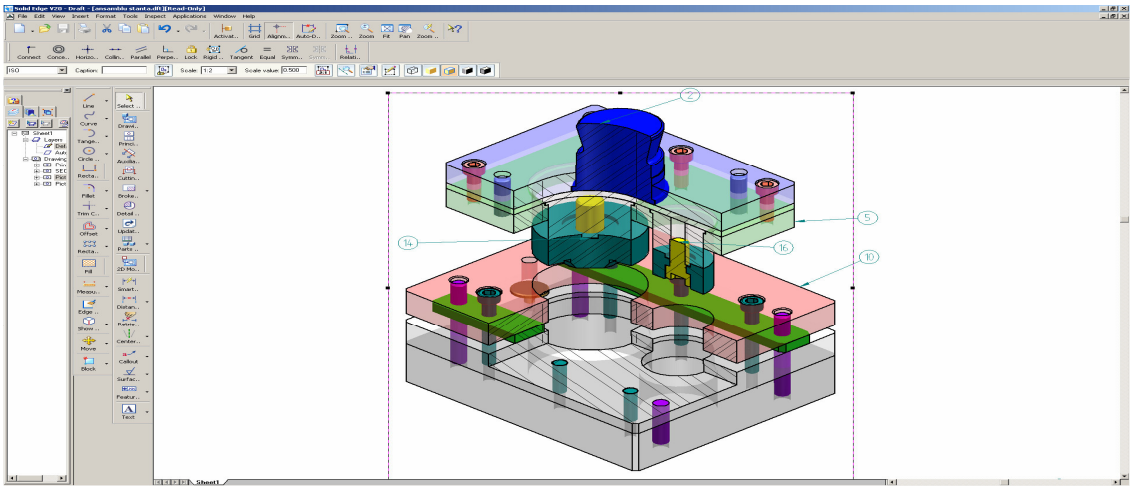

Figure 2. Parameterized assembly for a matrix

A clear and consistent correlation in the execution of drawings and related documentation help companies to avoid the occurrence of errors and delays in the manufacturing department while maintaining the advantage over competitors.

The steps to obtain an execution drawing for a parameterized solid are the following:

- Launching in the design medium a drawing session by clicking the button "Create Drawing" from "File" menu
- Establishing the name of the drawing file of *.dft type
- Establishing the space orientation of the solid item and the projection modality for the main projection;
- Establishing the modality of generating the projections, i.e. based on the European or U.S projection system
- Generating secondary views
- Obtaining sections/details
- Plotting the quotas required

3. Results

With an item of average complexity such as the geometrical shape is very clear in the axonometric representation it shade variant that all orthogonal projections, including sections and details can be obtained on the same drawing.

Mention must be made that with Solid Edge v.20 univocal correspondence can be achieved between modelling and drawing; i.e. any change in the dimensions related to the solid can be found after updating the **.dft* drawing. Reversely, this correspondence is not feasible, i.e. changes made to the execution drawing are not transmitted automatically by up-date to the solid model in the * par file. Also certain information from the indicator is calculated and written automatically into predefined positions such as: file name, the piece designer's name, piece material, mass in kilograms, date of design, etc.

In Figure 4, which is the overall view of a mould design, a very important CAD feature is underlined: the automatic positioning of all items and plotting the components table, adding series of information data such as material the work piece is made of, the number of pieces, the STAS related to the machine elements which have been taken from its own library, etc.

Automatic drawing of orthogonal or axonometric projections is performed similarly to the overall design. Thus for the mold in Figure 2 it can be obtained automatically both the overall design and the exploded drawing of all items properly positioned as shown in Figure 3.

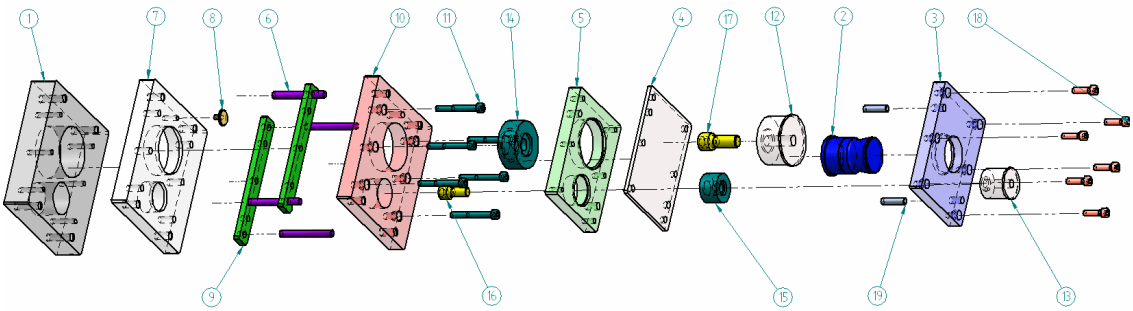

Figure 3. Catalogue overall drawing of exploded variant

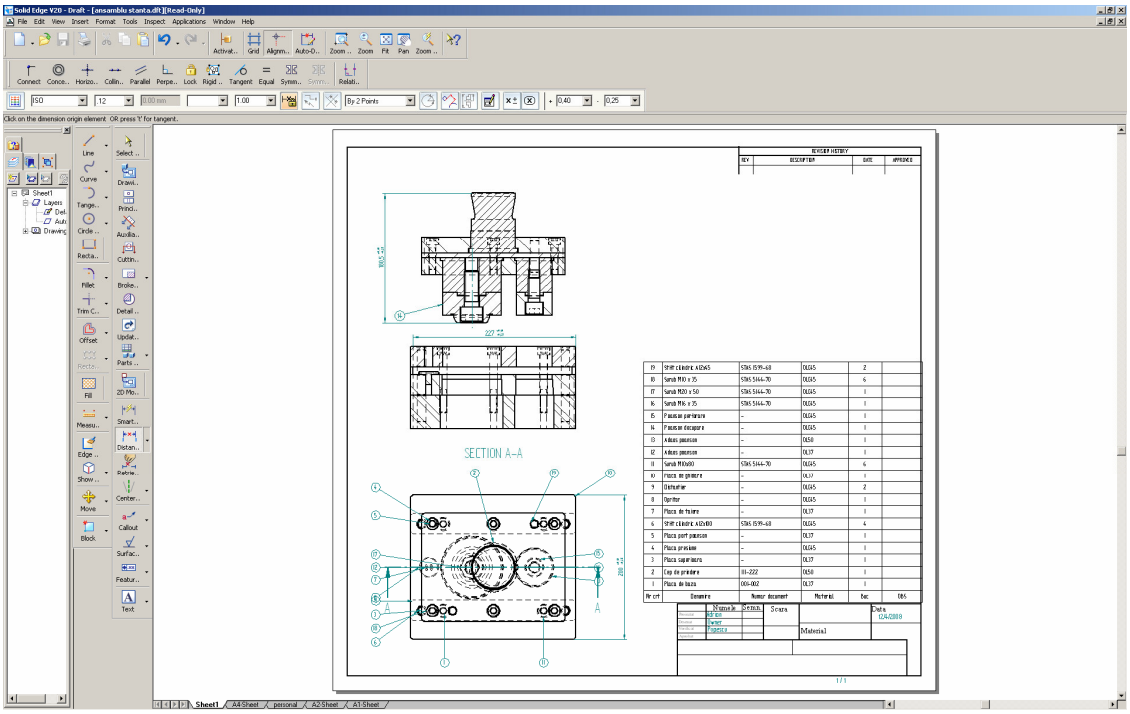

Figure 4. Overall drawing of a computer- aided mold design

4. Conclusions

The major advantages and also the most frequently invoked in the parametric design vs. classic design are:

- Using parametrically modelled solid pieces, the user can always see the implications in the whole assembly of parts after changing the size of a component
- To design assemblies, it is available for the user a system for making the constraints between parts, which further allows for total or partial constraints
- Solid Edge facilities allow for the analysis of the collisions between the assembly parts, enabling the creation of tables and exploded views for assemblies, etc.
- Automatic generation of the execution drawing and the unidirectional association between them and the three-dimensional model is one of the most important facilities provided by this software
- The drawings are generated in separate files of the type *.dft and views can be generated with the following characteristics: base, orthographic, full sectional, sectional offset, iso-sectional, detail, user-defined.

5. References

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