

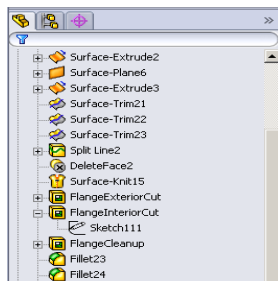
COMPUTER-AIDED DESIGN SYSTEM SOLIDWORKS: APPLICATIONS IN INDUSTRIAL DESIGN

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The large part of engineers' and designers' work is the execution of drawings, layouts and the design of details. In order to facilitate these tasks, computer technologies are used nowadays, specifically – Computer-Aided Design (CAD) – organizational and technical system consisting of trained personnel and complex hardware, software and other products [1]. One of such systems is SolidWorks, the product of SolidWorks Corporation (an independent division of Dassault Systemes (France)). This CAD system assists in solving various problems, ranging from pre-production design to managing data and processes.

Like any high-level CAD SolidWorks includes the following sub-programs: the CAD itself, CAE and CAM. CAD used for the development and design of various facilities, machinery parts and assemblies. Subroutine CAE (Computer-Aided Engineering) allows using computational methods (finite element method, finite difference method, finite volume method) to assess how the modeled part will behave in real-world operating conditions. CAM (Computer-Aided Manufacturing) is a software-calculating complex used for the computerization of the product manufacturing process [1]. In the field of graphic and 3D design, the most important is the CAD component that allows to create a virtual model of a future product. SolidWorks presents a wide range of possibilities for the realization of this task.

SolidWorks is a highly automated system that makes its mastering and use very comfortable process – simple geometric shapes can be created even by the person who works with CAD in a first time [4]. The program interface is intuitive and there is an analytic system reporting any users' error. One of the most useful and frequently used functions is the Feature Manager (pic. 1), which displays each sketch and performed detail, based on it.



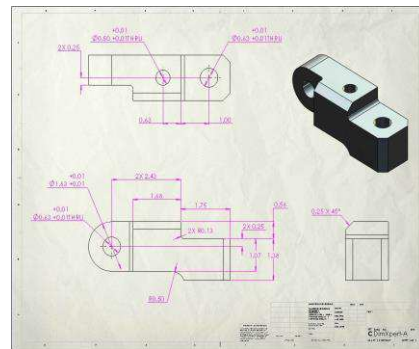
Pic. 1. Feature Manager

Of course, the capabilities of the SolidWorks package are not limited to simple details – objects of any complexity, from simple tableware items to such complex mechanisms as motorcycles (pic. 2) and ma-

chines can be designed with the CAD system. SolidWorks opens endless possibilities for engineers and designers to create and configure the elements of details and their compounds. SolidWorks makes it possible not only to design the item but also to prepare it for industrial manufacturing.



Pic. 2. A motorcycle model, created with SolidWorks



Pic. 3. SolidWorks Drawing

In addition to the 3D modeling SolidWorks also supports 2D drawing for sketches, pictures and drawings. The function of creating drawings for engineered facility is fully automated, it requires the minimal adjustments from the user, and all documentation created by the software is compliant with State Standard requirements [2] (pic. 3). Creation of 2D drawings in SolidWorks is also possible from geometric shapes and curves, like in a vector graphic editor. It is a useful feature and it becomes more comfortable to apply the created pattern to the surface of the object. Besides, SolidWorks has a large and diverse library of patterns (stones, metals, natural or whole colors) which can be used for any needs.

But what is the specific application of SolidWorks for industrial and 3D design? Just because SolidWorks allows you to design objects of any size and complexity of the form, the usage of it also has very extensive borders [3]. Here are only some of the objects of industrial design, which can be modeled using this CAD:

- furniture: with automatic drawing creation, it is possible not only to create a 3D model for an individual order, but also to instantly make a set of technical drawings of the object necessary for immediate start of production (in only a fraction of time needed to complete that job in another CAD system, Autodesk Inventor, where the Drawing is created many times longer due to the lack of native support for State Standard);

- tableware: SolidWorks offers a wide range of materials from the inside library, which allows you to design and see appearance of objects from different sorts of glass, porcelain and ceramic object long before their production (competing Autodesk Inventor package has a much smaller material library, what makes a visualization somewhat difficult);

- fixtures: 3D sketch feature allows to model any pendant-type light fixtures from a single sketch, and the FotoView 360 mode shows how they will look like with a real light thanks to high precision mapping used [4] (while the Inventor has less abilities to edit 3D designs and their interrelations);

- décor: this category may include almost everything that adorns homes – figurines, vases, various clocks and other objects, thanks to wide range of materials and tools, any model will be very close to the real object, and will meet all the requirements of the customer (SolidWorks has much more opportunities for customization and parameterization of the model in comparison with the Inventor);

- components or spare parts for cars/motorcycles: objects of any shape or size needed to repair or started to decorate the interior – all of them can be simulated using SolidWorks – realistic colors of materials will help to find the right one for salon or body, and the CAE subprogram will allow virtual durability tests and allows to save a large amount of time and money on prototyping and testing [2] (Inventor's CAE subsystem has more limits in the fields of functional analysis and object optimization in comparison with SolidWorks);

- machinery and Components: thanks to Assembly software it becomes possible not only to design a part, but also to gather parts into a mechanism and then to trace its operation (assembling objects in SolidWorks is much simpler and better information is presented so that mates can easily be changed should a revision be necessary, whereas Autodesk Inventor requires you to specify direction of mates by entering negative or positive values and then hoping the completed mate won't wreck the model).



Fig. 4. The model of desk in SolidWorks FotoView

Obviously it is very difficult to fit all of the things that can be modeled through SolidWorks in a small list. CAD systems are also used in aircraft industry, development of the firearms (also can be used for cold weapons), shipbuilding and other areas of design, which cannot be done without engineers, industrial designers and their CAD projects.

In addition to the variety of functions and ease of usage, SolidWorks also has other advantages that distinguish it from other products in the CAD market:

- helps a designer quickly become proficient 3D modeler and increases the speed to create and deliver designs;

- built-in intelligence takes the guess work out of 3D design;

- leverages 3D design data for quick communication of complex technical details with animations and visual instructions;

- lower total cost of ownership comes from higher efficiency [3].

In conclusion, it should be noted that for 20 years of its existence on the CAD market, SolidWorks became a big competitor to such products as AutoCAD and Autodesk Mechanical Desktop, SDRC I-DEAS and Pro / ENGINEER. The opportunity costs of NOT using SolidWorks design solutions can be very high. In a 2006 MIT survey of SolidWorks users, 95 % reported productivity gains, 54 % reduced their time-to-market by an average of 20 %, and overall materials savings averaged 18% [3].

References

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