THE ANNALS OF "DUNAREA DE JOS" UNIVERSITY OF GALATI
FASCICLE XIV MECHANICAL ENGINEERING, ISSN 1224-5615
2006

3D MODELLING A SPUR GEARING WITH SOLID EDGE

AS. DR. ING. GEORGETA HARAGA,
UNIVERSITATEA "POLITEHNICA" BUCURESTI

ABSTRACT

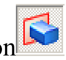
The software Solid Edge software is a useful 3D computer aided design (CAD) running under Windows. The commands and icons of Solid Edge software offer the possibility to design various solids. In this paper are presented the steps that guide at 3D modeling a spur gearing with straight teeth, using the software Solid Edge. Thus, in order to realize the model's purpose it is necessary to interference 2D with 3D and to know the theoretic geometric elements for a spur gearing.

1. Introduction

In this paper are presented the steps that guide to 3D modeling a spur gearing with straight teeth, using the software Solid Edge. A spur gearing is made up of from a pair of spur gears for mounting on parallel shafts. At the beginning, we will propose 3D modeling of the base shapes and for this we start with various types of gears. The gears can also be used between shafts, which can be parallel or inclined to one another. They are used to transmit power between shafts rotating usually at different speeds. In this paper, using Solid Edge program, we will propose by 3D modeling, only three types of gears: Spur gear, Spur Rack and Internal Gear.

2. Necessary stages for the realization of a spur gearing

Solid Edge Part is used to construct individual part models. Part models are constructed by adding and removing material from a base feature.
3D modeling of a spur gear is made with the Part module of Solid Edge software. This type of planning is essential for solids modeling.
In this paper, we will show the base steps that guide to 3D modeling a pair of spur gears for mounting on parallel shafts with straight teeth.
Spur gear - is a cylindrical shaped gear in which the teeth are parallel to the axis.
The first step is the construction of tooth profile using the *Protrusion* command. The Protrusion command constructs a protrusion by extruding a profile along a straight path.

A new Solid Edge Part file is created. We start by creating a straight tooth's profile gear  in the x-y plane and then we click the Fit button .
On the Feature toolbar, we can click one of the Protrusion button . On the ribbon bar, we click on the Finish button to accept the profile that can be seen in figure 1.

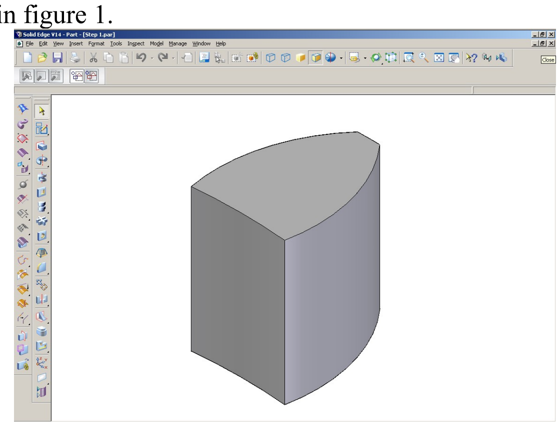


Fig. 1. The gear tooth's profile constructed using the Protrusion command

We are starting now to use the *Pattern* command that arranges selected elements in a circular pattern. Drawing circular pattern profiles is part of the pattern feature construction process. The Circular Pattern command is available when constructing a pattern feature or when drawing a sketch. We click the *Circular Pattern* button  on the Feature toolbar to select the gear tooth's profile in order to be multiplied. Thus, we will select where we want the center of the pattern circle to be and we click where we want the pattern to start. Further on, we will use

the ribbon bar boxes to define other characteristics of the pattern, such as the number of pattern occurrences, radius value, and count.
In figure 2 the direction to multiply tooth’s profile is represented.

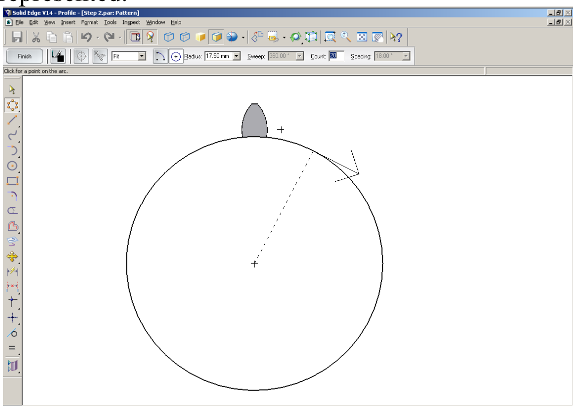


Fig. 2. The direction for tooth’s profile multiplication is shown.

In figure 3 is represented the circle division in 20 counts.

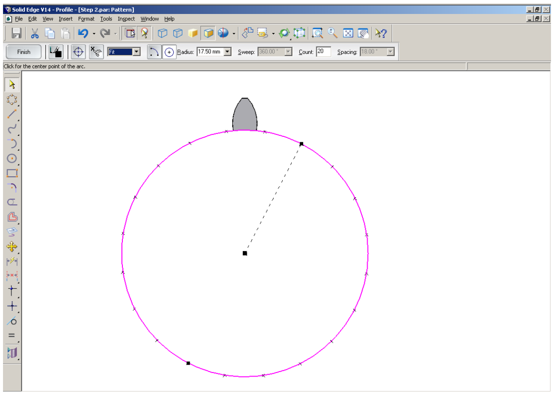


Fig. 3. The circle division

On the ribbon bar, we can select the Finish button to accept the profile as shown in figure 4.

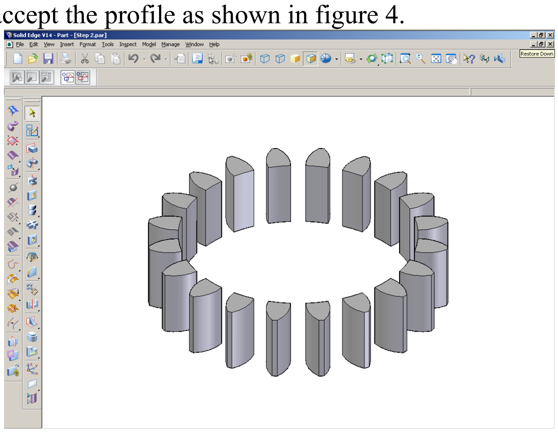


Fig. 4. The Circular Pattern command for the gear

The planes will be turned invisible for a better drawing clarity. After this, we will execute another protrusion that is being seen in figure 5.

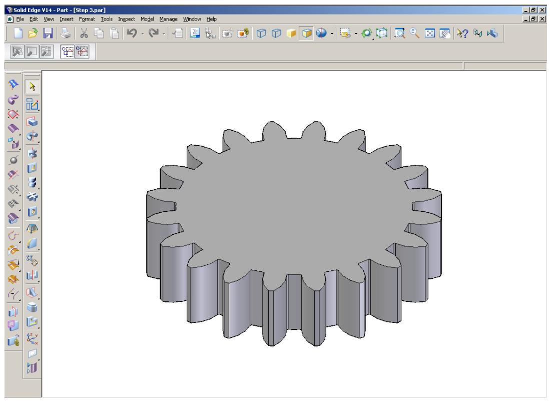


Fig. 5. The Protrusion 2 execution

We select the *Cutout* button  on the Feature toolbar. It is selected one of the horizontal planes and we will draw two circles at various diameters which can be seen in figure 6.

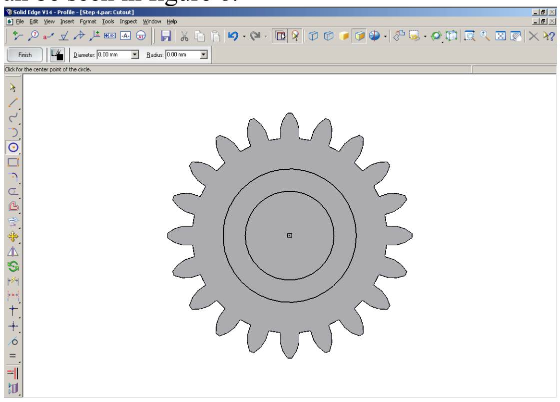


Fig. 6. The two circle drawing at various diameters

On the ribbon bar, the Finish button can be accessed to accept the profile and this is shown in figure 7.

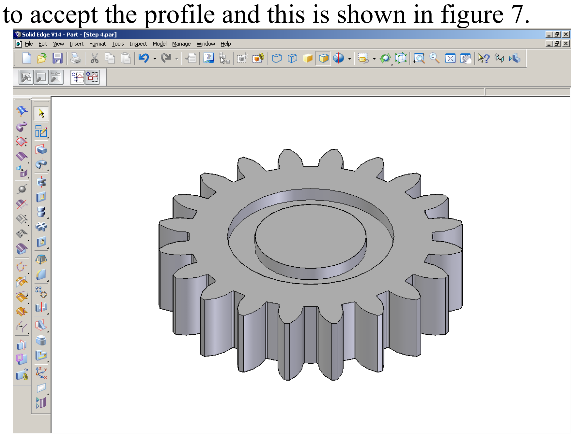


Fig. 7. The Cutout command

Further on, it is drawn the gear’s hub using again the Cutout command that can be seen in figure 8, as follows. Similarly, the operations from figure 7 and 8 repeated in other parts, too.

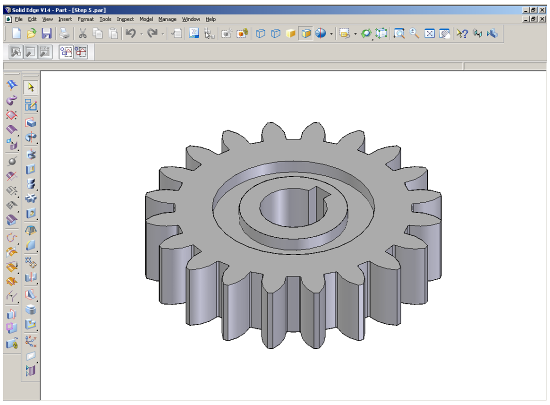


Fig. 8. The hub's gear representation

After the geometric elements of the spur gearing are calculated, we will draw the tooth's profile pinion using the Protrusion command that can be seen in figure 9.

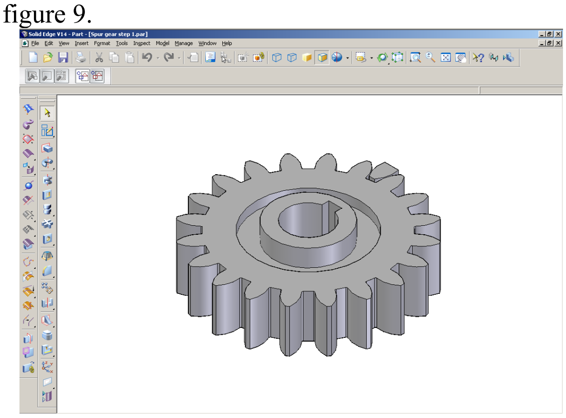


Fig. 9. The constructed tooth's profile pinion using the Protrusion command.

Similarly to the steps which guided to the tooth's profile multiplication (figure 4), the *Circular Pattern* button is clicked to select the tooth's profile pinion in order to be multiplied. On the ribbon bar, the Finish button can be clicked to accept the profile as shown figure 10.

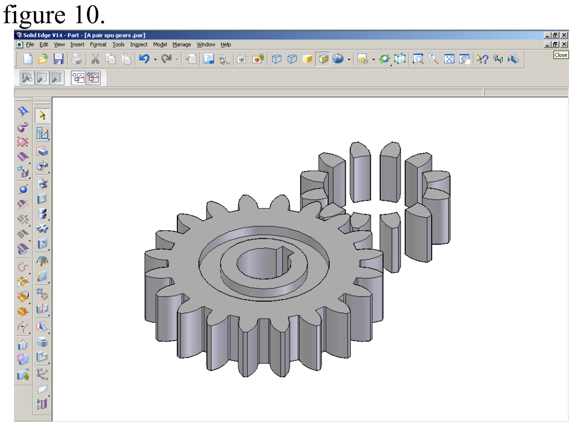


Fig. 10. The Circular Pattern command for the pinion

Afterwards, the necessary stages are covered to realize a spur gearing that can be seen in figure 11.

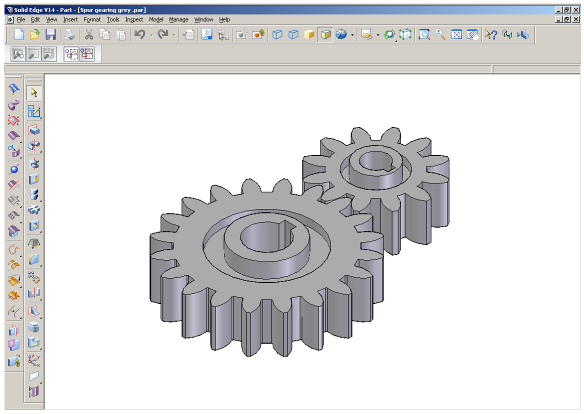


Fig. 11 The spur gearing using Solid Edge

3. Execution of the finite form of the spur gearing

We will select the Rotate command  and the spur gearing in figure 11 will be rotated. Solid Edge contains commands that work together and so they help us to manage part colors and styles. The texture can be opaque or transparent; at the end special effects will be created. The Color Manager window is opened and the steel color is selected as shown in figure 12.

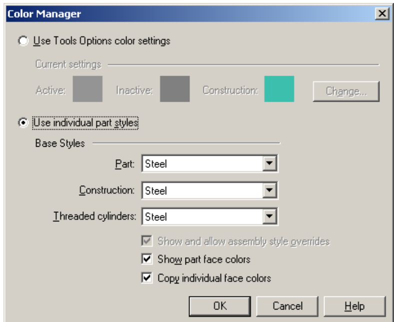


Fig. 12. The Color Manager window

After the Color Manager command is used we will reach figure 13:

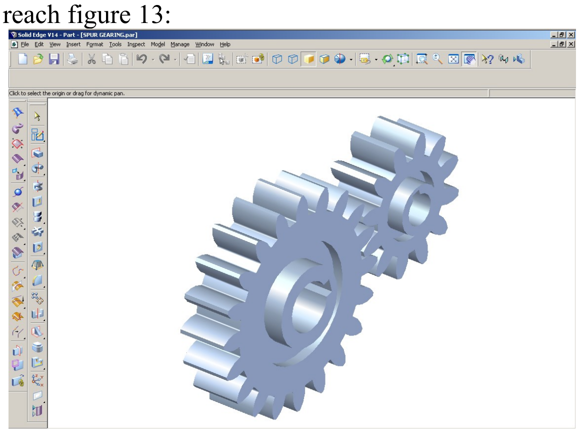


Fig. 13. The spur gearing for mounting on parallel shafts with straight teeth using Solid Edge

Other kinds of flanges designed by using Solid Edge are:

Spur Rack - is a linear shaped gear which can mesh with a spur gear with any number of teeth. The spur rack is a portion of a spur gear with an infinite radius

Internal Gear - is a cylindrical shaped gear but with the teeth inside the circular ring. It can mesh with a spur gear. Internal gears are often used in planetary gear systems.

In figures 14 and 15 we present 3D modeling of a Spur rack and internal gear using Solid Edge program. In this case, we don’t detail the necessary stages of the two models 3D modeling because they are represented in a similar way figure 13.

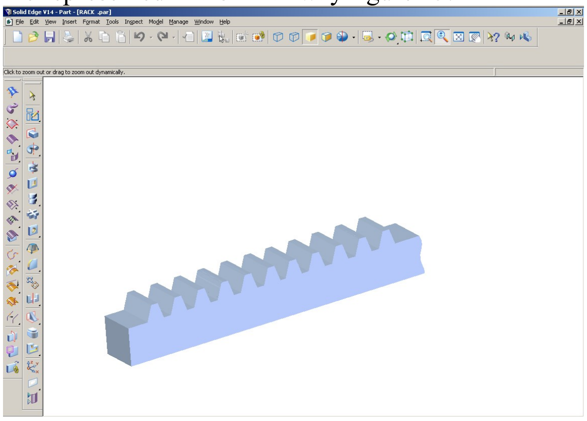


Fig. 14. The spur rack using Solid Edge

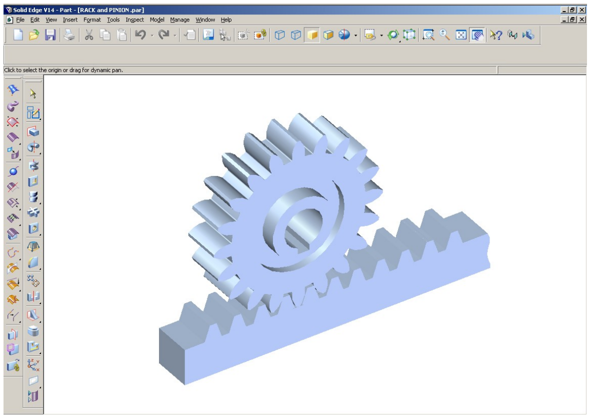


Fig.15 The rack and pinion using Solid Edge

At last, we will save the documents with extension par. and these will can be are closed.

4. Conclusions

This paper is addressed to all users interested in computer graphics. As an example, the spur gearing, spur rack and internal gear drawings are considered. The required steps for the drawings of the proposed design have been discussed in detail as well as the basic commands used in Solid Edge. Solid Edge is a power program of graphics, and its results can be seen in the 3D models presented in this paper.

5. Bibliography

[1] **Băduţ, M., Iosif, M.** *Bazele Proiectării cu Solid Edge*. Ed. Albastră, Cluj-Napoca, 2003.

[2] **Ion, E. E.., Haraga, G.** *Curs de desen tehnic*. Ed. MATRIX ROM, ISBN 973-685-641-0, Bucureşti, 2003.

[3] **Haraga, G., Ion, E.E.** *The use of Solid Edge software in 3d modelling.* International Conference on Engineering Graphics and Design. Bucharest, 2005, pag.57-60.

[4] **Haraga, G., Ion, E.E., Ion, G. C.** *Main steps in the realization of 3d model using Solid Edge*. International Conference on Engineering Graphics and Design. Bucharest, 2005, pag.53-56.