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Parametric Modeling of Straight Bevel Gear Based On Pro/E

Fumin WANG[1], Jie LI[2], Huijie WU[3]
[1]School of Mechanical Engineering, Taiyuan University of Science and Technology, Taiyuan 030024, CHINA
[2]School of Mechanical-electronic and Automobile Engineering, Beijing University of Civil Engineering and Architecture, Beijing 100044, CHINA
[3]School of Mechanical Engineering, Taiyuan University of Science and Technology, Taiyuan, 030024, CHINA
Corresponding Author: Jie LI

Abstract: The use of the three-dimensional Pro-E software can build straight bevel gears that fast parametric modeling, when modeling the each dimension corresponding relationship of bevel gears needed to be strict constraints in each step, and added relations to toolbar dialog box, Then we can get the three-dimensional structure model of the straight bevel gear .When we need other dimensions of the bevel gear , only to change any one or several of the model parameters can be modified and meet the designer's intent, and can greatly shorten the product design cycle, to meet the production and experimental techniques and accuracy requirements on the basis of cost savings. So Parametric modeling has been more and more used by the Research and Development Center and engineering and technical personnel

Keywords: Straight Bevel Gear; Pro/E; Parametrize Modeling

1. Introduction

With the rapid development of the national economy, machinery and equipment play an increasingly important role, the gear is one of the main parts of machinery and equipment, while the bevel gear is mainly used to transmit motion and power between the two axes intersect, such as widely used industrial transmission equipment, vehicles differential, locomotives, ships, power plants, steel mills, railway track detection. In this paper, In this paper, the main use of 3D software Pro/E that detailed account of the parametric modeling process of the straight bevel gear, so we can directly call the existing bevel gear or modify the parameter values the rapid generation of bevel gear sizes in the modeling process.

The Pro /ENGINEER of the United States Parametric Technology Corporation (PTC) is the latest generation of CAD / CAE / CAM software, what is parameterized, feature-based solid modeling system.Pro / ENGINEER parametric design adds the idea of the process to establish the size of the numerical model to model basis, just grab some typical characteristics graph can be drawn graphics.Pro-E software utilizing parametric modeling capabilities, designers only need to change the basic parameters of the new model can be generated to improve the utilization of products, cost savings, shorten the product design cycles.

2. Pro-E Parametric Modeling Process

The parametric modeling process of straight bevel gear mainly includes the following steps:

1) Define the basic parameters. The basic parameters include modulus m, teeth z, tooth width b, cone apex angle δ, pressure angle α, addendum coefficient hax, headspace coefficient cx , modification coefficient x.

2) Open the Pro-E, build a new part file, cancel the default template and click the OK button.

3) Click Tools - Parameter button to add the basic parameters, and then click Tools - Relations button to add the following relationship:

d=m*z
db=d*cos(a)
da=d+2*m*cos(c/2)
df=d-2*1.2*m* cos(c/2)
dx=d-2*w*tan(c/2)
dxb=dx*cos(a)
dxa=dx+2*m* cos(c/2)
dxf=dx-2*1.2*m* cos(c/2)

Table 1. Basic Parameters of Straight Bevel Gears

m	z	b	δ	α	hax	cx	x
2	20	20	25	20	1	0.2	0

Click the OK button, you can see the corresponding dimension value D, DB, DA, DF, XD, XDB, XDA, XDF in the parameter list, where D series followed are the big end of the pitch circle, the base circle,the addendum circle, the tooth root circle, and XD series followed are the small end of the pitch circle, the base circle, the tooth tip circle, the tooth root circle.

4) Click Insert - Mixed - protrusion, select the FRONT plane as the sketching plane, drawn to the DA as the di-

ameter of the first round, with a diameter of XDA for the second round, to b generate entity for depth. as shown in Figure 1:

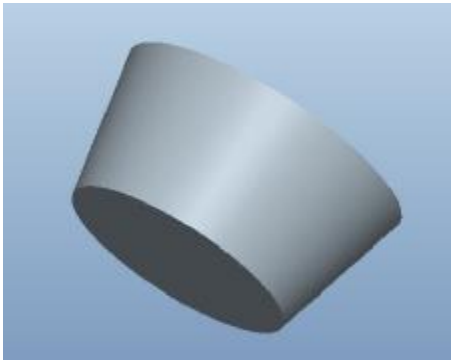

Figure 1. The 3D drawing generation

5) In DF, D is the diameter of the large end of the sketch in two circles. Then click the curve - from the equation - select a coordinate system - Cartesian, created the first involute, enter the equation:

afa=60*tr7h
r=db/2r7h
x=r*cos(afa)+pi*r*afa/180*sin(afa)r7h
y=r*sin(afa)-pi*r*afa/180*cos(afa)r7h
z=0

as shown in Figure 2:

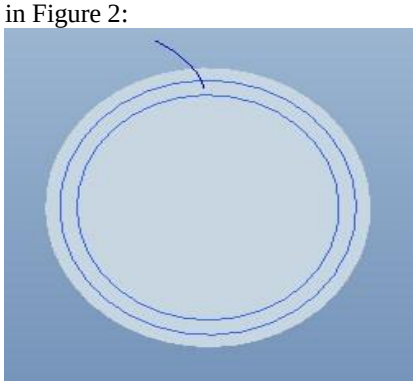

Figure 2. The created the first involute

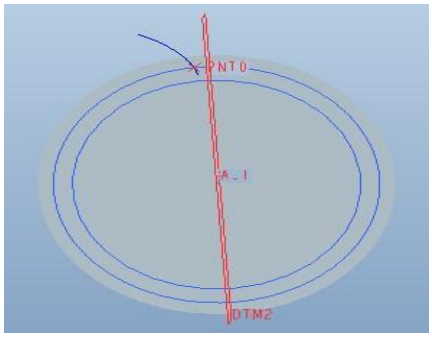

Figure 3. The Created datum plane DTM2

6) By involutes and D as the diameter of a circle to create a reference point PNT0, created by the Right and the Top plane reference axis A-1, create a datum plane DTM1 by the reference point PNT0 and the reference axis A-1, create a datum plane DTM2 by DTM1 and A-1, then mirroring the involute obtained big-endian two involutes, as shown in figure 3 and figure 4:

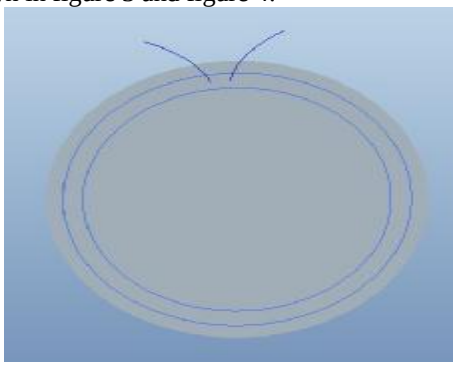

Figure 4. The mirror of involute

7) With B as the distance to translate coordinates for CS0, at the small end to XDF, XD diameter of sketching two circles. Then click the curve - from the equation - Select CS0- Cartesian coordinate system, create the first involute and enter the equation:

afa=60*tr7h
'r=xdb/2r7h
x=r*cos(afa)+pi*r*afa/180*sin(afa)r7h
y=r*sin(afa)-pi*r*afa/180*cos(afa)r7h
z=0

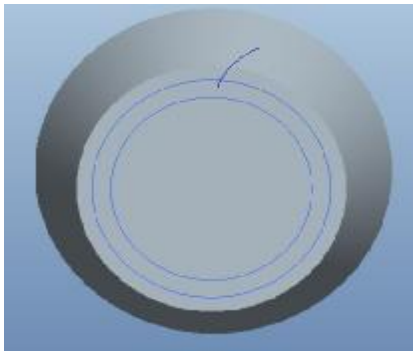

Figure 5. Create the first involute in the small end

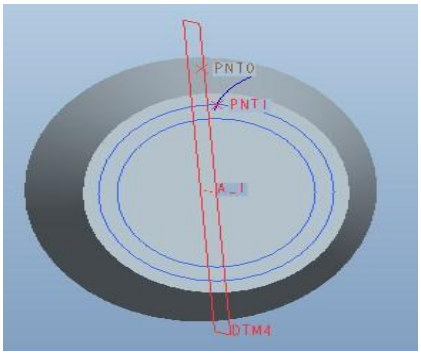

Figure 6. The created datum plane DTM4

8) By involutes and XD as the diameter of a circle to create a reference point PNT3, PNT3 and reference axis A-1 created by the reference point reference plane DTM3, with A-1 and DTM3 create a datum plane DTM4, then mirror the involute, get small ends of the two involutes, as shown in figure 6 and figure 7:

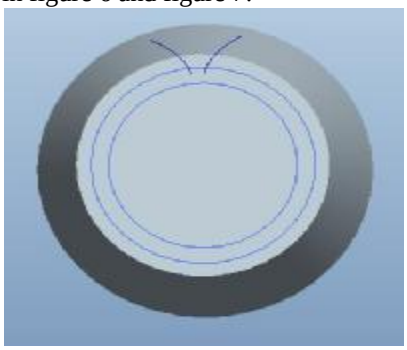

Figure 7. The mirror of involute

9) By inserting - Mixed - incision command, use the "Ring", "trim" command to create gear groove shape, the input depth b generate a first tooth. As shown in figure 8 and figure 9:

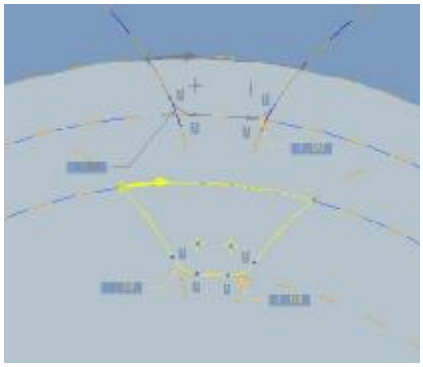

Figure 8. The created gear groove shape

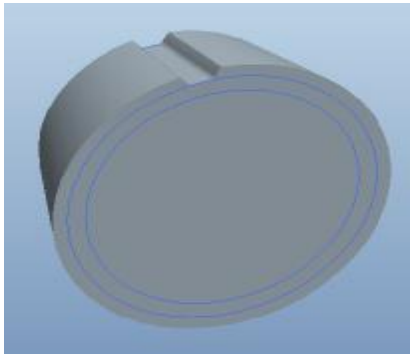

Figure 9. The first generation of gear tooth

10) Using the array to generate a bevel gear shaft, select the reference axis A-1, the number of z, the rotation angle is 360, and the bevel gear to the stretching axis of the shaft bore and groove assembly, as shown in figure 10 and figure 11:

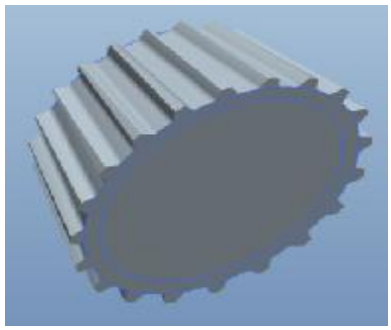

Figure 10. The generated bevel gear shaft array

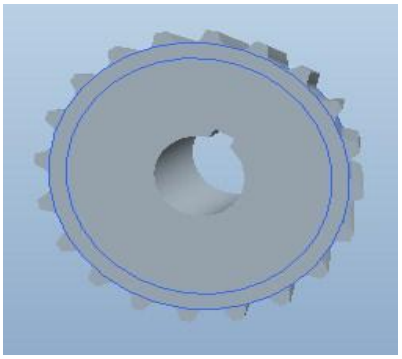

Figure 11. The tensile and the keyway

Through the above that described the parametric modeling of the straight bevel gear in the process of modeling, and we only need to input the basic parameters, and it can be automatically calculated by the corresponding size, and it is convenient and efficient completion of the modeling process, but also the parametric modeling of other types of gear, and the establishment of a database at any time call.

3. Summary

This paper mainly describes that Pro-E has a powerful parametric modeling capabilities , for the parametric modeling of straight bevel gear in the construction machinery used. We can see from the process of straight bevel gears of the modeling, just put straight bevel gears of the basic parameters added to the relationship, in the process of modeling each operation involved in the size of the basic parameters are used to establish a relationship so that it represents, then to add and save the relationship, it can automatically calculate to build the straight bevel gear in the parameters modeling .when the designers need other models only need to change the basic parameters which can automatically generate the appropriate entity, according to the designer's intent modeling, and can shorten the design cycle, saving costs. As everyone knows, there are many varieties of gear, if we can parameterized modeling for each type of gears. And then put them into a database ,so we can

easily call them, do not have to re-enter all of the data in each model, and it can be very convenient and fast to complete parts design.

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