Parameterized Design of Cycloidal Pin Wheel Reducer Based on Creo2.0.

Wenjuan Li [a], Jinghua Liu, Pengfei Yu, Kaige Yang, Xiaohe Zhao

Advanced Manufacturing Technology Center, Shandong university of science and technology, Qingdao 266590,China

[a] 937358742@qq.com

Abstract

Cycloid pin gear reducers are widely used in aerospace, mining, nation defense sector, lifting transportation departments , chemical machinery, and other occasions depend on their compact structure, high carrying capacity, smooth operation, large transmission ratio and reliability. Through research status in-depth study of cycloid, this paper introduces the principle of forming a tooth profile of cycloid, obtains the standard equation of cycloid tooth profile, Since cycloid profile design is more complex, so to some extent, it affects the development of cycloid gear reducer. Therefore, this paper aims to use software Pro/e to get on parametric design on cycloid reducer and make parametric modeling. It can save time on design. And it is easy to modify, thereby providing convenience for future study design.

Keywords

Cycloid pin gear reducers, parametric design, creo2.0.

1. Introduction

Cycloidal pinwheel reducer has a high transmission rate, and the characteristics of stable transmission [1]. Cycloidal wheel reducer has a large transmission ratio; The cycloidal wheel reducer is very reliable, produces little fluctuation and has long working time. Cycloidal wheel reducer is a kind of small reducer, which occupies a small area and is easy to carry. Compared with other reducers in the same condition, the size of the cycloid is significantly reduced and its advantages are obvious. The cycloidal wheel has high load bearing capacity and strong shock resistance [2], this is because the cycloid gear and pin gear at the same time achieve the meshing teeth is more, so, on average, each pair of teeth on the force is small, thus improve the use time of cycloid gear and maximize the benefits achieved. Cycloidal wheel drive is not only able to revolve around its own axis, but also can rotate around other axes. Based on the above characteristics, cycloidal wheel can develop rapidly and occupy a place in the high-speed development of modern machines.

2. The Basic Principle of Cycloidal Pin Wheel Drive

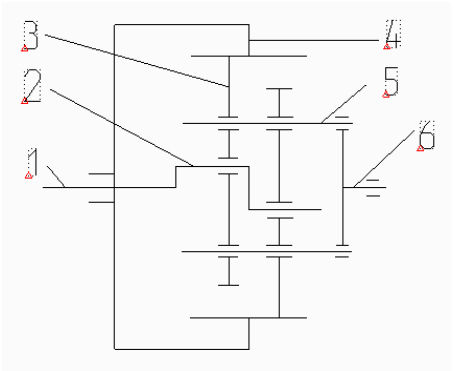

Fig. 1. Cycloidal pin wheel drive schematic diagram

First by the high speed input shaft drives the double eccentric sleeve 1 2 movement, then driven by double eccentric sleeve 2 cycloid gear 3 movement, after the transfer campaign to needle wheel 4, finally by needle wheel drives the dowel pin 4 movement, and the motor output.

3. Creo2.0 Parameterized Modeling Capabilities.

Creo2.0 has powerful 3d modeling capabilities and is versatile, and the secondary development tools in creo2.0 mainly include user-defined features, family tables, j-link, Pro/Program, Pro/TOOLKIT, etc.

Pro/TOOLKIT is a secondary development tool in Pro/e, which includes a large number of C languages, programming in C language, and cooperating with Pro/e [3]. The Pro/TOOLKIT can access the database directly and communicate with external security. Pro/Program can also be used to make model beams, first edit the Program, set key parameters, and then be specific to abstract, find the relationship, and finally determine the model size by parameters. For the standard series, it is especially suitable for the family table because it is better at managing similar parts. The family table needs to first establish a complete part as commander, which is the standard, and then define each parameter in the family table so that the size and shape of the parts can be controlled [4]. J-link is based on JAVA and is more practical, independent of the system and more satisfying. User-defined feature is the custom, users according to their own requirements, set the characteristics of the product, set up their own parameters, applicable to a specific product is relatively special part, will save a lot of time for the subsequent work.

4. Parametric Design of Main Components.

4.1 Cycloidal Wheel Parametric Modeling

(1) Create new parts, select tool-parameters, and do the following Settings, as shown in the figure.

名称	类型	值	指定	访问	源
Z1	实数	20.000000	☐	完全	用户定义的
CK	实数	15.000000	☐	完全	用户定义的
ZXK	实数	70.000000	☐	完全	用户定义的
XZK	实数	30.000000	☐	完全	用户定义的
KS	实数	6.000000	☐	完全	用户定义的
RG	实数	10.000000	☐	完全	用户定义的
A	实数	2.500000	☐	完全	用户定义的
K1	实数	0.500000	☐	完全	用户定义的
FBY	实数	130.000000	☐	完全	用户定义的

Fig. 2. The parameter value of cycloid pin wheel.

Enter the following formula in the relationship:Z2=Z1+1;R2=A*Z2;RZ=R2/K1

(2) Using the equation, the contour curve of cycloidal wheel is drawn. Model-base-curve - comes from the equation, selects cartesian coordinates and enters the equation editor. Enter the following equation.

F1=t*(360+360/Z1)*Z1

A1=RZ/Z2*cos(F1/Z2)-A*cos(F1)

B1=-RZ/Z2*sin(F1/Z2)+A*sin(F1)

C1=sqrt(A1*A1+B1*B1)

X=RZ*sin(F1/Z2)-A*sin(F1)+RG*B1/C1

Y=RZ*cos(F1/Z2)-A*cos(F1)-RG*A1/C1

Z=0

The outline of the cycloid wheel is shown below.

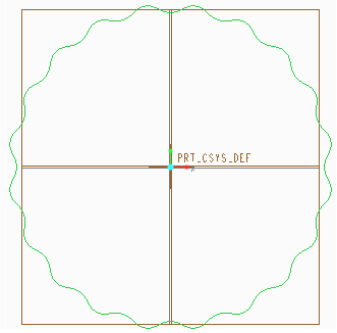

Fig. 3. Cycloid outline

(3) Draw the cycloid wheel, as shown below

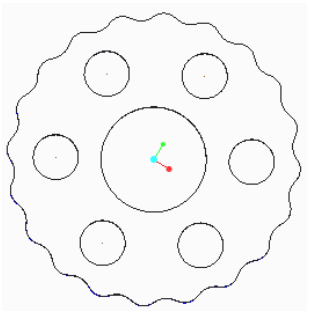

Fig. 4. Cycloidal wheel model

(4) Parameterize each dimension. The left model tree command - edit-tool-relationship, the previous dimension becomes the parameter, and the following relationship is added in the relationship dialog:

d0=CK; d15=ZXK; d17=XZK; d19=360/KS

d18=FBY/2; p22=KS

(5) Model regeneration

4.2 Eccentrically Set Parametric Modeling

The parametric modeling process is the same, and the parameters are defined as follows:

名称	类型	值	指定	访问	源
DESCRIP...	字符串		☑	完全	用户定义的
MODELED_BY	字符串		☑	完全	用户定义的
A	实数	2.500000	☐	完全	用户定义的
WJ	实数	60.000000	☐	完全	用户定义的
NJ	实数	40.000000	☐	完全	用户定义的
L1	实数	50.000000	☐	完全	用户定义的
JK	实数	10.000000	☐	完全	用户定义的
JH	实数	45.000000	☐	完全	用户定义的

Fig. 5. The parameter value of Eccentric sleeve

The relationship is as follows:d0=L1; d1=WJ; d2=NJ; d3=L1; d4=WJ; d6=NJ

d5=A; d9=JK; d10=NJ+2*A; d7=2*L1; d8=NJ

The model diagram is as follows

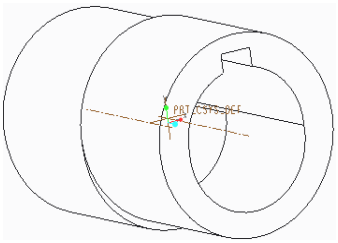

Fig. 6. Eccentric sleeve model

4.3 Output Shaft Parametric Modeling.

The definition parameters are shown below.

名称	类型	值	指定	访问	源
DESCRIP...	字符串		☑	完全	用户定义的
MODELED_BY	字符串		☑	完全	用户定义的
FZJ	实数	200.000000	☐	完全	用户定义的
SCZJ	实数	60.000000	☐	完全	用户定义的
FLH	实数	20.000000	☐	完全	用户定义的
SCZC	实数	80.000000	☐	完全	用户定义的
FBY	实数	130.000000	☐	完全	用户定义的
XZK	实数	30.000000	☐	完全	用户定义的
KS	实数	6.000000	☐	完全	用户定义的

Fig. 7. The parameter value of Output shaft

Writing relationships:

d0=FLH; d1=FZJ; d2=SCZC; d3=SCZJ; d5=XZK

d6=FBY/2; d7=360/KS; p10=KS

The model is shown below.

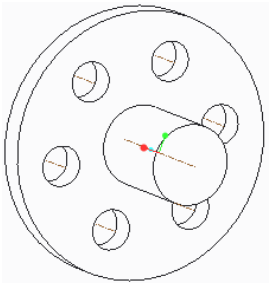

Fig. 8. Output shaft model

4.4 Input Shaft Parametric Modeling.

Define parameter variables

名称	类型	值	指定	访问	源
DESCRIP...	字符串		☑	完全	用户定义的
MODELED_BY	字符串		☑	完全	用户定义的
DJ	实数	60.000000	☐	完全	用户定义的
XJ	实数	40.000000	☐	完全	用户定义的
CD1	实数	100.000000	☐	完全	用户定义的
CD2	实数	40.000000	☐	完全	用户定义的
JK	实数	10.000000	☐	完全	用户定义的
CD3	实数	60.000000	☐	完全	用户定义的
CD4	实数	10.000000	☐	完全	用户定义的

Fig. 9. The parameter value of Input shaft

Defining relationships:d0=CD2; d1=DJ; d2=CD1; d3=XJ; d7=CD4

d8=JK; d9=(CD1-CD3)/2; d10=CD3

Defining relationships:

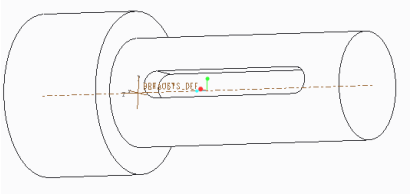

Fig. 10. Input shaft model

5. Conclusion

Cycloidal gear reducer is now widely used and has a great influence on People's Daily life. The advantages of speed reducer is numerous, very representative, but about its manufacturing is relatively complex, so the parametric design of it is particularly important, parameterized design, for the second design of cycloid gear is relatively easy, simply by the changes of some specific

parameters, can achieve the reconstruction of the model, greatly saves manpower and material resources. And it is of far-reaching significance for the long-term development of the reducer.

References

[1] Zhengang Rao. Planetary drive mechanism design (second edition) [M]. Beijing: defense industry press,1994:159-207.

[2] Genhua Jiang,Qisong Chen. Mechanical transmission design manual. [M]. Part ii. Beijing: coal industry press.,1983.4:764.

[3] Pengyue Li. The development of parametric design system for cycloidal gear reducer. [D]. Hebei university of technology.2013

[4] Ye Chen,Xiaobin Fan,Wenjie Xu. Design technology of connecting rod parameterization based on Pro/E secondary development. [J]. Shaanxi university of science and technology, 2009(5):111-113