Influence of parameters of deep groove ball bearings on Performance

Deep groove ball bearing as an important part of printing and packaging equipment, its performance directly affects the overall performance and performance of the machine. In this paper, the deep groove ball bearing of high-speed carton-pasting machine in printing and packaging equipment is studied. When the carton-pasting machine runs at high speed to produce carton, its working efficiency can reach 60,000 carton/h. The inner structure of deep groove ball bearing is simple, but the movement relationship and load distribution of its internal components are relatively complex. In order to ensure the best working condition of bearings,Meceoo Bearing Industrial Co.ltd mainly studies the performance of deep groove ball bearings. According to the research, the main performance parameters of the bearing are rotation-roll ratio, stiffness, vibration and noise. These parameters have an important impact on the bearing. Based on this, Meceoo Bearing Industrial Co.ltd will study the parameters that affect the structure and performance of deep groove ball bearings, and provide theoretical basis and guidance for the development and design of high-performance bearings, so as to improve the printing and packaging equipment. Work efficiency.

In recent years, many experts and scholars have never stopped exploring the bearing performance. Meceoo Bearing Industrial Co.ltd and others have studied the double-layer bubble thin-film shaft, and found the influence of its single-side clearance and support stiffness on the bearing performance.

Bearing parameter analysis

1.1 fatigue life

For rolling bearing fatigue life calculation is the most widely used is a batch of bearings in a certain speed 10% of the fatigue failure occurred when the working time, called the basic rated life, recorded as L. Warda is predicted by half space method and finite element method. The main failure mode of bearing is fatigue spalling of rolling surface caused by cyclic repeated stress, i. e. contact fatigue.

1.2 stiffness

Based on the static calculation method of HERTZ theory, the relationship between the displacement of deep groove bearing stiffness and the load is established. Static method considers the influence of the radius of curvature of inner and outer raceway, the diameter, number and contact angle of roller on the deformation of deep groove ball bearing. According to the moving direction of the bearing, it can be divided into axial stiffness and radial stiffness, and the stiffness of the bearing is composed of contact stiffness and oil film stiffness in series.

2 work performance

Deep groove ball bearings are widely used in printing and packaging equipment, especially in high-speed cartridge pasting machine. This example takes the deep groove ball bearing 6300 in cartridge pasting machine as an example. Its outer diameter is 35 mm, inner diameter is 10 mm, width is 11 mm, roller diameter is 6.35 mm, inner ring curvature radius is 3.27 mm. The radius of the outer ring is 3.33 mm, and the number of rollers is 7.

The volume is 207 GPa and the Poisson's ratio is 0.3. When calculating the influence of a parameter on fatigue life, the remaining parameters remain unchanged.

2.1 fatigue life

The fatigue life of deep groove ball bearings with different number of rollers, diameter and curvature radius of inner and outer rings is studied. Based on the above theoretical analysis, the corresponding computer programs are written in Matlab language. From the relationship curve between the bearing life and the number of rollers, it can be seen that the number of rollers and the life of the bearing is linear relationship. Increasing the number of rollers will increase the bearing life, the life increase is 77.78%. According to the relationship curve between the bearing life and the roller diameter, the roller diameter is proportional to the life of the bearing, but it is nonlinear. The life of the bearing can be doubled when the roller diameter increases by 1%. According to the relationship curve between bearing life and inner ring curvature radius, bearing life is inversely proportional to inner ring curvature radius, but it is nonlinear. The life reduction caused by the change of inner ring curvature radius within 1% is 40.04%. According to the curve of bearing life and outer ring curvature radius, the life of bearing is inversely proportional to the curvature radius of outer ring. The life reduction caused by the change of outer ring curvature radius within 1% is 12.69%.

2.2 stiffness

In this paper, the effects of the number of rollers, diameter and the radius of curvature of inner and outer rings on the stiffness of deep groove ball bearings are studied. Based on the above theoretical analysis, the corresponding computer programs are written in Matlab language. The analysis results of stiffness and roller number, roller diameter, inner ring curvature radius and outer ring curvature radius are shown in Table 1. It is shown that the radial stiffness of the bearing is very sensitive to the number of roller, while the axial stiffness of the bearing is more sensitive to the change of inner and outer ring curvature radius and roller diameter.

3 Simulation analysis of 3 [deep groove ball bearings](#)

The contact stress of 6300 deep groove ball bearing is simulated by Ansys software. The finite element results of simulation are compared with the HERTZ theory results.

3.1 establish a model

The 6300 example of deep groove ball bearing in the box machine described above is an example, and a three-dimensional solid model is established. To simplify the calculation, a simplified meshed rolling bearing model is established, as shown in Fig. 1, and at the section formed

Symmetric constraints are applied.

3.2 simulation analysis

Based on the finite element model established above, the maximum contact stress of bearing inner ring is 3990 MPa and the maximum contact stress of bearing outer ring is 3348 MPa by Ansys. The finite element solution is compared.

The maximum contact stress error of inner and outer ring is 0.758% and 2.13% respectively with HERTZ theoretical solution. The allowable range of the maximum contact stress error between the inner and outer rings of bearings is 7%. Therefore, the finite element solution in this paper is consistent with the HERTZ theoretical solution. The equivalent stress of bearing inner and outer rings is shown in Figure 2, and the maximum equivalent stress appears at a certain position below the contact surface, not the contact surface, which is consistent with the theoretical analysis.

Considering the influence of bearing parameters such as roller diameter and roller number, the influence of these factors on the contact stress of bearing is analyzed, and the finite element calculation results are compared with the HERTZ theoretical calculation results, which provides

experimental basis for theoretical analysis of bearing parameters on bearing performance.

3. Both the HERTZ theoretical solution and the finite element solution show that the contact stress of the inner and outer rings of the bearing decreases with the increase of the roller diameter, and the error is less than 2%. This is mainly due to the increase of the diameter of the bearing roller, which makes the overall bearing capacity increase. The relationship between the contact stress of the inner and outer ring and the number of rollers is shown.

4. Both the HERTZ theoretical solution and the finite element solution show that the contact stress of inner and outer rings decreases with the increase of the number of rollers, and the error is less than 5%. This is mainly due to the increase in the number of deep groove ball bearing rollers, which is equivalent to the reduction of the load on each roller.

4 Conclusion

There are thousands of deep groove ball bearings in the box paster. Under the condition of high speed operation, bearing performance is very important to equipment performance and production efficiency. Therefore, the fatigue life, stiffness and roller number, roller diameter, inner ring curvature radius and outer ring curvature radius of deep groove ball bearings are discussed in detail. Detailed research, and through the simulation analysis of deep groove ball bearing, the theoretical data based on HERTZ theory and simulation results are compared and verified, and the following conclusions are drawn.

1) The life of deep groove ball bearings is directly proportional to the number and diameter of rollers, but inversely proportional to the curvature radius of inner ring and outer ring. The change of life caused by the change of roller number is 77.78%. When the roller diameter is changed within 1%, the bearing life is doubled. Therefore, the bearing fatigue life is sensitive to the change of roller number and roller diameter.

2) The radial stiffness of deep groove ball bearing is more sensitive to the number of roller, and the axial stiffness is more sensitive to the roller diameter, inner ring curvature radius and outer ring curvature radius. The variation of the radial stiffness caused by the change of roller number is 23.08%.

3) The simulation results are close to the theoretical results, which shows that the model is relatively reasonable and can be applied to practical production.