Christopher King

Mechanical Design II Homework 06

Christopher King

2018141521058

Mechanical Design 2

Class Section 01

10/14/2021

Problem 1

What are the components of a deep groove rolling element bearing?

What is the static load rating? What is its parametric symbol?

What is the dynamic load rating? What is its parametric symbol?

What is spalling?

Solution:

a. A deep groove ball bearing is composed of an inner race, an outer race, steel balls that fit between the inner and outer, move along the track called raceway, and a cage that prevents the steel balls from falling out or contact in one another.
b. Static load rating is The load that will produce a total permanent deformation in the raceway and rolling element at any contact point of 0.0001 times the diameter of the rolling element and used to determine the maximum permissible load that can be applied to a non-rotating bearing or estimate thrust load of a rotating/non-rotating bearing. Its parametric symbol is C_0.
c. Dynamic load rating is the first evidence of fatigue with spalling or pitting of an area of 0.01 in^2 and used to estimate the life of a rotating bearing. Its parametric symbol is C_{10} or C.
d. Spalling is the fracture of the running surfaces and subsequent removal of small, discrete particles of material. Spalling can occur on the inner ring, outer ring, or balls. This type of failure is progressive and once initiated will spread as a result of further operation. It will always be accompanied by a marked increase in vibration, indicating an abnormality.

Problem 2

An 02-series deep-groove ball bearing is required for an application in which the life requirement is 40 kh at 520 rev/min. The design radial load is 725 lbf. The reliability goal is 0.90. Find the equivalent bearing load C10 and recommend a bearing using Table 11–2.

Solution:

$$C_{10} = F_D\left(\frac{\mathcal{L}_D n_D}{\mathcal{L}_R n_R}\right)^{\frac{1}{a}} = (725\ \text{lbf}) \times \left[\frac{(40\ \text{kh}) \times (520\ \text{rpm}) \times 60}{10^6}\right]^{\frac{1}{3}} = 7.8057\ \text{klbf}$$

$$= 34.7215\ \text{kN}$$

I select the bear with 50 mm bore in Table 11-2.

Problem 3

The other bearing on the shaft of Question 02 to be a 03-series cylindrical roller bearing. For a 2235-lbf radial load, find its equivalent C10 and recommend a bearing using Table 11–3. The reliability goal is 0.90.

Solution:

$$C_{10} = F_D\left(\frac{\mathcal{L}_D n_D}{\mathcal{L}_R n_R}\right)^{\frac{1}{a}} = (2235\ \text{lbf}) \times \left[\frac{(40\ \text{kh}) \times (520\ \text{rpm}) \times 60}{10^6}\right]^{\frac{1}{\frac{10}{3}}} = 18.973\ \text{klbf}$$

$$= 84.3961\ \text{kN}$$

I select the bear with 50 mm bore in Table 11-3.

Christopher King