

Experimental Study on Cage Dynamic Characteristics of Angular Contact Ball Bearing in Unstable Working State

CATEGORY OR KEYWORDS

Ball bearing, Cage, Processes of startup and shutdown, Critical speed

AUTHORS AND INSTITUTIONS

Shijin Chen ^a, Xiaoyang Chen ^{a*}, Qingqing Li ^a, Jiaming Gu ^b

*Corresponding Author email: xychen@shu.edu.cn

^aSchool of Mechatronic Engineering and Automation, Shanghai University 200072, China

^bShanghai Tian An Bearing Co. Ltd., Shanghai 201108, China

INTRODUCTION

It is well known that rolling bearings are more prone to failure under variable operating conditions such as variable speed, variable acceleration, and variable load. However, related research was few due to the complexity of this problem. A comprehensive experimental investigation about the cage motion in different acceleration and deceleration processes has been carried out based on the cage dynamic characteristics test device.

ABSTRACT

During the acceleration and deceleration processes of the bearing inner ring, the kinetic relationship of collision and the friction between the cage and the rolling element is complex, which has an important influence on the dynamic characteristics and stability of the rolling bearing and its cage [1-2]. In this paper, experimental investigation of dynamic motions of a cage was carried out on the processes of startup and shutdown in an angular contact ball bearing. It was shown that acceleration and deceleration of the bearing inner ring have a significant effect on the movement of the cage. During the startup process, there is a critical speed. When the inner ring speed is lower than the critical speed, the cage mass center swings along the guide land within a range of 70°. Above the critical speed, the cage mass center enters a circular whirl trajectory, and the greater the acceleration, the higher the critical speed. It is interesting that during the shutdown process, the inner ring speed does not continuously decrease, but goes through three stages: rapid reduction phase, stability or even small increase phase and slow decrease phase. In the rapid deceleration phase, the cage mass center trajectory is a circle, and its diameter is equal to the guiding clearance. After that, the cage mass center trajectory is also circular, but the diameter is smaller than the guiding clearance, or swings within the guide clearance. Both acceleration and deceleration process, the cage skidding is very serious.

ACKNOWLEDGMENTS

This study was supported by the National 'the twelfth five year' Projects of Science and Technology of China.

REFERENCES

- [1] Wang Y.L., Wang W.Z., Qing T. and Zhang S. H., "Dynamic Analysis of Angular Contact Ball Bearing-rotor System during Start up and Shut Down," *Journal of Mechanical Engineering*, **54**(9), pp. 9-16.
- [2] Yao T.Q., Wang L.H., Liu X., B. and Huang Y.Y., "Dynamic Stability Analysis on the Cage of Ball Bearing under Varying Working Environment," *Journal of Vibration and Shock*, **35**(18), pp. 172-180.