INFLUENCE OF THE CAGE ON THE FRICTION IN LOW LOADED THRUST BALL BEARINGS

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Abstract: *The authors investigated experimentally the friction torque in a thrust ball bearing operating at very low axial load in lubrication conditions. The experiments were realized by using spin–down methodology. The results evidenced the influence of the sliding friction between the cage and the balls on the total friction torque. It was concluded that at very low loads the friction between cage and balls in a thrust ball bearing has an important contribution on total friction torque.*

Keywords: *rolling friction, friction in cage–balls contacts, thrust ball bearing, lubricated contacts, spin–down methodology.*

1. Introduction

In a thrust ball bearing the total friction torque *Tz* is a result of a lot of friction processes: rolling friction between balls and the two races, sliding friction between balls and cage, pivoting friction between balls and races and drag friction between balls and oil. In the last period, the authors in Refs. [1,2,3] experimentally investigated the total friction torque *Tz* in a modified thrust ball bearing having only three balls without cage both in mixed and full film lubrication conditions by using the spin–down methodology. The experiments realized at very low loads evidenced that, in lubrication conditions the friction resistance in ball–race contact caused by lubricant has the dominant contribution at the total friction torque. Also the experiments evidenced a good correlation with friction resistance in lubricated ball–race contacts developed in [4]. In dry conditions, Refs. [5,6] by using the same modified thrust ball bearing having only three balls evidenced that the values of experimental rolling friction between the balls and races for very low normal loads exceed with about an order of magnitude the theoretical values. In Ref. [7] experiments by using the spin–down methodology were carried out and it was determined the total friction torque in 51205 thrust ball bearing axially loaded with 4.26 N, lubricated with two mineral oils having viscosities of 60 mm^2/s and 350 mm^2/s and operating between 100 and 400 rpm. The experimental results were compared with SKF analytical methodology [8] and important differences were obtained. The authors concluded that these differences are as result of the influence of friction generated in balls–cage contacts. The SKF methodology for determining the total friction torque in a thrust ball bearing *Tz* includes following four components given by equation:

$$Tz = M_{rr} + M_{sl} + M_{seal} + M_{drag}, \qquad (1)$$

where M_{rr} is the rolling component, M_{sl} is the slip component, M_{seal} is the seal system component, M_{drag} is the component due to