The Static and Dynamic characteristics of an Offset Journal Bearing Lubricated with micropolar Fluid

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1. Introduction

Advances in technology necessitate the development of improved lubricants as micropolar fluids. Huang et al. [1] presented the static and dynamic characteristics of finite-width journal bearings lubricated with micropolar fluids. The offset journal bearing is considered quite attractive owing to its relative ease of manufacture. The static and dynamic performances characteristics for the offset-halves journal bearing were presented by Malik et al.[2]. In Recent investigation, the static characteristics of a non-circular journal bearing lubricated with a micropolar fluids were studied by Rahmatabadi et al.[3]. In the present work, static and dynamic characteristics in terms of; Load carrying capacity, attitude angle, friction coefficients, the critical mass and whirl ratio are calculated for an offset journal bearing lubricated with a micropolar. The effects of different values of micropolar parameter on the static and dynamic characteristics of the journal bearing are determined.

2. Modified Reynolds Equation

The modified Reynolds equation is written in the following form [1]:

$$\frac{\partial}{\partial\theta}\left[\bar{G}\frac{\partial\bar{p}}{\partial\theta}\right]+\left(\frac{R}{B}\right)^2\frac{\partial}{\partial z}\left[\bar{G}\frac{\partial\bar{p}}{\partial z}\right]=6\frac{\partial\bar{h}}{\partial\theta}+12\frac{\partial\bar{h}}{\partial t} \quad (1)$$

Where

$$\bar{G}\left(N,\bar{h},L\right)=\bar{h}^{-3}+12\frac{\bar{h}}{L^2}-6\frac{N\bar{h}^{-2}}{L}\coth\left(\frac{NL\bar{h}}{2}\right)$$

The non-dimensional film thickness $\bar{h}$

$$\bar{h}=1-\bar{\varepsilon}\left(\cos\theta\sin\phi-\sin\theta\cos\phi\right)\mp\delta\cos\theta \quad (2)$$

3. Results and discussion

The values of coupling number N considered in this study are; 0.3, 0.6 and 0.9. The values of the non-dimensional characteristics length L are ranging from 0 to 60. Based on the results presented in this paper, the following conclusions can be made;

* The load carrying capacity increase with increasing the coupling number N.
* The attitude angle and the friction coefficient decease with an increasing of the coupling number N.
* The attitude angle and the friction coefficient for the offset journal bearing lubricated with a micropolar fluid are higher than those for Newtonian fluid.
* The critical mass increases while the whirl ratio decreases with an increase of the coupling number N for the offset journal bearing.
* At high values of L, the critical mass and the whirl ratio for micropolar fluid converge to those for Newtonian fluid.
* The stability of the offset journal bearing is improved by using a micropolar fluid compared to a Newtonian fluid.

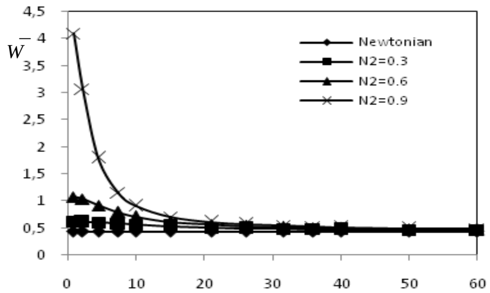

Fig. 1.Variation of Load $\bar{W}$ with L

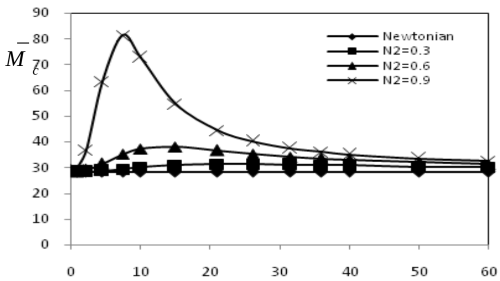

Fig. 2. Variation of Critical Mass $\bar{M}_c$ with L

4. References

[1] Huang, T., Weng, C. and Chen, C.,“ Analysis of finite journal bearing with micropolar fluids,” Wear ,123, 1988, 1-12.

[2] Malik, M. , Chandar, M. and Sinhasan, R.,“ Design Data for Offset-Halves Journal Bearings in Laminar and Turbulent Regimes, ” ASLE Trans., 25, 1980, 133-140.

[3] Rahmatabadi, A. D, Nekoeimehr, M. and Rashidi, R.,“ Micropolar lubricants effects on the performance of noncircular lobed bearings,” J. Tribol. Int., 43, 2010, 404-413.