Study on the Electrorheological Squeeze Film Damper for Journal Bearings

林穎聖、李春穎

E-mail: 9419535@mail.dyu.edu.tw

ABSTRACT

The purpose of this study is to investigate the squeezing performance of the journal bearing with electrorheological (ER) fluid as working medium. The ER fluid was modeled as bi-viscous fluid first. The bearing capacity and the dissipated torque of the bearing due to the periodic eccentric motion were derived. An experimental apparatus was setup to measure the loading capacity of the ER bearing under different controlled electric field strengths. The calculated result correlated well in trend with the measured one though some mismatch occurred due to the difficulty in obtaining the ER material properties.

Keywords : Electrorheological fluid, squeeze-flow, journal bearing

Table of Contents

REFERENCES

[1] H. See, J.S. Field, and B. Pfiste, 1998, “ The response of electro- rheological fluid under oscillatory squeeze flow, ” Journal of Non-Newtonian Fluid Mechanics, 84, pp.149-158.

[2] P.G. Nikolakopoulos and C.A. Papadopoulos, 1996, “ High speed journal bearings lubricated with electro-rheological fluids: An experimental investigation, ” International Journal of Modern Physics B, 10(23&24), pp.3045-3055.

[3] P.G. Nikolakopoulos and C.A. Papadopoulos, 1997, “ Controllable misaligned journal bearings lubricated with smart fluids, ” Journal of Intelligent Material Systems and Structures, 8, pp.125-137.

[4] P.G. Nikolakopoulos and C.A. Papadopoulos, 1998, “ Controllable high speed journal bearings,lubricated with electro-rheological fluids. An analytical and experimental approach, ” Tribology International, 31(5), pp.225-234.

[5] J.L. Sproston, S.G. Rigby, E.W. Williams, and R. Stanway, 1994, “ A numerical simulation of electrorheological fluids in oscillatory compressive squeeze-flow, ” Journal of Physics. D:Applied Physics, 27, pp.338-343.

[6] 粘鴻祺，2003，“ 電流變液在轉盤間之擠壓承載研究 ”，碩士論文，大葉大學機械工程系，彰化。 -68- [7] 程志堅，1997，“ 電黏性流體的動態特性量測及智慧型結構模擬 ”，碩士論文，大葉大學機械工程系，彰化。

[8] C.Y. Lee and C.Y. Wen, 2002, “ The oscillatory squeeze flow of electrorheological fluid considering the inertia effect, ” Smart Materials and Structures, 11, pp.553-560.

[9] S. Morishita and J.I. Mitsui, 1992, “ Controllable squeeze film damper (an application of electro-rheological fluid), ” Journal of Vibration and Acoustics, 114, pp.354-357.

[10] 綿林英一、田原久祺，1994，“ 最新軸承漫談 ”，建宏出版社，pp.125-154。

[11] C.W. Wu and H.X. Sun, 1995, “ A new hydrodynamic lubrication theory for bilinbar rheological fluids, ” Journal of Non-Newtonian Fluid Mechanics, 56, pp.253-266.

[12] 趙宮志，2002，“ 電流變液阻尼器之設計與測試 ”，碩士論文，大葉大學機械工程系，彰化。

[13] 王登?、施明璋，2000，“ 電流變液體特性及機械之應用實例 ”，機械月刊，26(9) ,pp. 314-321。

[14] T. Kuriyagawa, M. Saeki, and K. Syoji, 2002, “ Electrorheological fluid-assisted ultra-precision polishing for small three-dimensional parts, ” Journal of the International Societies for Precision Engineering and Nanotechnology, 26, pp. 370-380.
[15] 趙曉鵬、楊俊剛，2001，“ 電流變技術在工程中的應用 ”，機械月刊,27(7) ,pp. 390-397。