Vol. 40, No. 4 (2018) 670-680, DOI: 10.24874/ti.2018.40.04.13

Tribology in Industry

www.tribology.rs

RESEARCH

Investigation of Cavitation in a Finite Journal Bearing Considering the Journal Speed and Couple Stress Fluids Effects

M.A. Mahdi[a], A.W. Hussain[a], H.H. Hadwan[a]

[a] *University of Babylon- College of Engineering/ Al-Musayab, Babil, Iraq.*

Keywords:

Journal bearing
Cavitation
Couple stress fluids
Shaft speed

Corresponding author:

Mushrek A. Mahdi
University of Babylon- College of Engineering/ Al-Musayab, Babil, Iraq.
E-mail: engmushrek@yahoo.com

A B S T R A C T

A theoretical analysis of the combined effect of journal speed and couple stress fluids (CSF) on the performance characteristics of a cavitated finite journal bearing (FJB) has been presented in this paper. Depending on the Elrod cavitation algorithm (ECA), the solution to the modified Reynolds equation is achieved. The bearing parameters are affected by both the journal speed and CSF. From the results obtained, it is detected that the non- Newtonian lubricants (CSF) produce enhanced in the fill-film pressure, load-capacity, as well as reduces the Sommerfield number and a small drop in the values of the bearing side leakage flow. The results obtained in this work specify that the characteristics of the bearing are affected significantly by this effect. The achieved results have been compared with that published by other works for the bearing operating with pure lubricant and showed to be in a good agreement.

1. INTRODUCTION

The phenomenon of the cavitation is occurring in several lubricated problems. In tribological environments of a hydrodynamic journal bearing (JB), the lubricant shearing produced high rates of heat, and the rupture in oil film happens in the diverging region of the geometry, where the lubricant film pressure drops below the vapor pressure (vapor cavitation), or below the atmospheric/saturation pressure of the dissolved gases and thus the gas cavities appear. The lubricant properties vary significantly in the cavitated zone. Numerous numerical treatment and relations have been modified to correctly simulate this phenomenon. The Reynolds boundary conditions have been commonly applied due to, it's not complex in applications or employment. Reynolds boundary conditions can't treat the film re-formation boundary and enforce mass-conservation. To treatment the ensure mass continuity and film re-formation, Jakobsson and Floberg [1] and Olsson [2] suggested a model organized known as JFO cavitation model. The JFO model, supposed that the lubricant pressure in the inactive zone is constant ($P = P_{cav}$); therefore, the gradient of the pressure is null in the cavitation (inactive) zone. Also, the model that prepared by JFO offers a set of limits in order to conserve the mass at