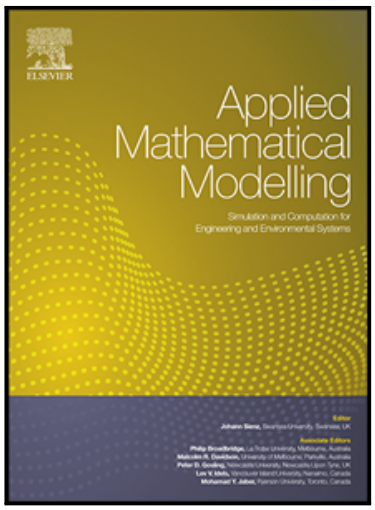

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PII: S0307-904X(18)30366-4
DOI: https://doi.org/10.1016/j.apm.2018.07.048
Reference: APM 12401

To appear in: *Applied Mathematical Modelling*

Received date: 26 July 2017
Revised date: 16 July 2018
Accepted date: 31 July 2018

Please cite this article as: Yongfang Zhang , Xianwei Li , Chao Dang , Di Hei , Xia Wang , Yanjun Lü , A SEMI-ANALYTICAL APPROACH TO NONLINEAR FLUID FILM FORCES OF HYDRODYNAMIC JOURNAL BEARING WITH TWO AXIAL GROOVES, *Applied Mathematical Modelling* (2018), doi: https://doi.org/10.1016/j.apm.2018.07.048

A SEMI-ANALYTICAL APPROACH TO NONLINEAR FLUID FILM FORCES OF HYDRODYNAMIC JOURNAL BEARING WITH TWO AXIAL GROOVES

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Highlights

1. A semi-analytical approach to nonlinear fluid forces of journal bearing under the cavitation boundary condition is proposed.
2. The fluid film forces calculated by the proposed method agree well with the results by the finite difference method.
3. The method facilitates the accurate calculation of the fluid film force of journal bearing and saves the computing costs.

ABSTRACT

A semi-analytical approach to nonlinear fluid film forces of hydrodynamic journal bearing with two axial grooves under the cavitation boundary condition is proposed in this paper. The pressure distribution of the Reynolds equation of finitely long journal bearing with axial grooves is expressed as a particular solution and a homogeneous solution forms. The particular solution and the homogeneous solution are separated respectively in an additive form and a multiplicative form by the method of separation of variables. The circumferential separable function of the homogeneous solution can be expanded based on the infinite series of trigonometric functions. The pressure distribution of the particular solution is obtained by the Sommerfeld transformation. The termination positions of fluid film are determined by the continuity condition. The analytical expressions of the nonlinear fluid film forces of finitely long journal bearing with two axial grooves are obtained. It can be seen that the fluid film forces calculated by the proposed method agree well with the results by the finite difference method. Meanwhile, the effects of the bearing parameters on the nonlinear fluid film forces are analyzed.

Keywords: Nonlinear fluid film forces, The method of separation of variables, Sturm-Liouville theory, Journal bearing with two axial grooves, Cavitation boundary condition.

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