A New Structural Stiffness Model for Bump-type Foil Bearings: Application to Generation II Gas Lubricated Foil Thrust Bearing

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Abstract:

Abstract A new structural stiffness model for the compliant structure in foil gas bearings is introduced in the first part of this work. The model investigates the possibility that the flat segment between bumps, in bump foil strip, may deflect laterally and separate from the rigid bearing surface, also it considers the interaction between bumps in the bump foil strip, the friction between the bump foil and the surrounding structure. The validity of the analytical solution was verified through direct comparison with previous numerical and analytical models. In the second part of this work, the introduced bump foil model is used to investigate the static characteristics of Generation II gas foil thrust bearing. The numerical simulations of the coupled fluid-structure interactions revealed that the foil thrust bearings share many features with their rigid bearing counterpart and the results showed clearly that the load carrying capacity of foil thrust bearings increases nonlinearly with the rotation speed and is expected to reach an asymptote as the rotation speed exceeds certain value. The effects of ramp height and interface friction (i.e., friction at bump foil/rigid bearing interface and bump foil/top foil interface) on the static characteristics of Generation II foil thrust bearings are investigated.

Keywords:

Structural Stiffness Model, Generation II Foil Thrust Bearings, Microturbomachinery.

Published In:

ASME Journal of Tribology, Vol. 136 - No. 4, 041701(1) - 041701(13)