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A NUMERICAL STUDY OF THE DYNAMIC CHARACTERISTICS OF AN ORIFICE COMPENSATED THREE-PAD HYDROSTATIC SQUEEZE FILM DAMPERS

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ABSTRACT

The Hydrostatic Squeeze Film Damper composed of pads bearing has better dynamic characteristics than other anti-whirl configurations, i.e, good suppression of whirl, good damping at critical speeds, overall good performance, wide range of design parameters, and moderate cost. The advantage to use the three-pad hydrostatic squeeze film dampers (HSFDs) compared to the four-lobe/pad hybrid/hydrostatic journals bearing (HJBs) presents in reducing of the cost coming from the need of a feeding system (pumps, filters, tanks, etc.), the quantity of volumetric flow rate, and in the control of the rotor vibrations and bearing transmitted forces for high speed. The aim of this research is to study the dynamic characteristics of an orifice compensated three pads hydrostatic squeeze film damper (HSFD). Linear modeling was performed using a numerical method in order to study the effects of orifice diameters, bearing dimensions ratio and concentric pressure ratio on the film thickness, flow, feeding Reynolds number and dynamic characteristics of an orifice compensated three pads hydrostatic squeeze film damper. It assumed that the fluid flow is incompressible, laminar, isothermal, and steady-state. The finite difference method has been used to solve Reynolds equation governing the lubricant flow in film thickness of hydrostatic bearing. The numerical results obtained are discussed, analyzed and compared between three lobe hybrid journals bearing available in the literature. The results show the three-pad HSFD has better dynamic characteristics than three and four lobe hybrid journals bearing due to their high stiffness and zero cross-coupling terms.

KEY WORDS: Hydrostatic bearing, Squeeze film lubrication, rotor bearing dynamics, stiffness, damping