PARAMETRIC ESTIMATION OF THE DYNAMIC CHARACTERISTICS OF A ROTOR-BEARING SYSTEM

By

SUNIL ITTY MATHEW

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ABSTRACT

The objective of this thesis is to study the changes in the stiffness and damping characteristics of a hydrostatic air bearing, for changes in pocket size dimensions and supply pressure. Two precision air bearings with short (1.0 x 1.0 inch) and long (2.4 x 1.2 inch) pockets, respectively, were fabricated and tested. Load deflection curves were obtained from a static test. Trajectories of the rotor center (periodic response) were obtained for varying eccentricity ratios, speeds and unbalance mass. From the periodic response, parametric estimation was used to obtain numerical values for the dynamic coefficients.

Analysis of the static test results revealed that the static stiffness coefficients were much higher for the short pocket bearing when compared to the long pocket bearing, for the same applied load and supply pressure.

Analysis of the dynamic test results, for the two bearings, revealed that the onset of resonance occurred at low rotor speeds with the introduction of unbalance mass and/or reduction in supply pressure. In all test cases (varying eccentricity ratios and unbalance mass), dynamic stiffness and damping coefficients increased with speed.

Recommendations to further the study of the dynamic characteristics of the two hydrostatic air bearings are increasing the range of study of the load deflection curves, effect of increasing the eccentricity ratio (greater than 0.1) and effect of changing the radial clearance between the rotor and the bearing housing.