Dynamic Coefficients of a Tilting Pad With Active Lubrication: Comparison Between Theoretical and Experimental Results

This paper deals with the validation of the mathematical model for predicting the equivalent stiffness and damping of an active tilting-pad bearing. The active bearing design includes an injection nozzle in the pad and a hydraulic supply system featuring a servovalve, which enables to modify the pressurized oil flow into the bearing clearance. The servovalve is governed by a control signal, obtained in open- or closed-loop configuration. The mathematical model includes the dynamics related to journal, tilting pads, and associated hydraulic system. First, the model results are tested against experimental results from the literature for industrial grade passive tilting pad bearings. This initial validation is followed by a comparison with experimental identification results obtained from a test rig featuring the active bearing design. Good overall agreement is observed in both configurations. The results provide an overview about the feasibility of modifying the bearing impedance by means of the active lubrication system, both in open-loop (fixed control signal), or closed-loop, as a function of the journal position and proportional derivative (PD) controller gains.