Experimental Identification of Dynamic Coefficients of Tilting-Pad Bearings with Active Lubrication

This article presents the experimental identification of the equivalent dynamic coefficients of an actively lubricated bearing under different lubrication regimes, namely: passive (no injection flow), hybrid (constant injection flow) and feedback-controlled (variable injection flow) lubrication. The main goal is to provide an overview on the feasibility of modifying its dynamic properties via active lubrication. The pressurized oil injection flow, which enables the hybrid and the feedback-controlled lubrication regimes, is regulated by a hydraulic control system composed of a) a high pressure oil supply unit, b) servovalves, c) radial injection nozzles, d) displacement sensors and e) well-tuned digital controllers which turn the bearing static and dynamic properties controllable. A scaled-down industrial rotor, composed by a flexible rotor supported by a four rocker LBP tilting-pad journal bearing featuring active lubrication under light load conditions, is used for such a goal. The experimental identification is performed in the frequency domain by means of the measured FRFs and a finite element model of the rotor. The comparison between results under the different lubrication regimes, presented along with their expanded uncertainty, provides experimental evidence of the modification of the bearing properties via the active lubrication.

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