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EXPERIMENTAL IDENTIFICATION OF FORCE COEFFICIENTS IN AN INTEGRAL SQUEEZE FILM DAMPER

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An integral squeeze film dampers (ISFD) offers the advantage of a lower number of parts, a shorter axial span, a lighter weight, split manufacturing, and higher tolerance precision Depending on the design requirement, an ISFD can be used to shift the rotor natural frequency to increase the operation safety margin between the running shaft speed and the critical speed; or to offer damping to enhance the stability of a rotor-bearing system. The reports details the results of an experimental and analytical endeavor to quantify and to predict the dynamic force coefficients of an ISFD. The test element has four arcuate film lands, 73^o in arc extent, at a diameter of 157 mm. The film axial length equals 76 m and the clearance *c* is 0.353 mm. The lubricant is an ISO VG46 oil supplied at a low pressure (1 to 2 bar) and ~ 47 ^{o}C temperature. The damper has its ends sealed via end plates with a gap produced by an installed shim. Three sets are assembled with gaps equal to 0.53 mm. 0.43 mm and 0.28 mm. The measurements show the ISFD produces direct damping and inertia coefficients that increase with the static eccentricity albeit at a lower rate than predictions from the computational model ISFDFLEX®. The damper with the tightest sealed ends (gap =0.28 mm < *c*) shows 22 more damping that the open ends ISFD; however it also shows a significant (unexpected) stiffness hardening effect that contradicts the predictions. Added mass coefficients are significant for both the open ends ISFD and the sealed ends configurations with gaps 0.43 mm and 0.53 mm, This added mass coefficient exceeds the test element physical mass. ISFDFLEX® predicts well the damping coefficients, but largely under predicts the added masses. The experimentally estimated damping and inertia force coefficients offer relevant empirical evidence that strengthens prior art on ISFDs. As per predictions, the model produces accurate damping coefficients albeit the fluid inertia (virtual mass) coefficients are much lower than those obtained during the experiments.