ABSTRACT

Bolander, Nathan W.. M.S.M.E., Purdue University, December, 2002. An Experimental Investigation of Thrust Washer Lubrication. Major Professors: Farshid Sadeghi and Carl R. Wassgren, School of Mechanical Engineering.

Surface geometry modifications such as grooves and dimples are examined as a method for designing a self-preserving thrust washer. An experimental test rig is presented that enables accurate measurements of the film thickness generated by the modified thrust washers. The measurements indicate that grooves and dimples can produce significant load support with grooves generally less sensitive to changes in speed than dimples. The larger and deeper dimples considered generate a relatively greater film thickness than shallower dimples. The density of surface features plays a negligible role in the overall thrust washer performance. Experimental measurements of film thickness correlate well with computational results when an appropriate value of viscosity is used. Despite having surface features that were much deeper than a typical film thickness, the computational model was able to accurately predict the behavior of the flow. A 'reservoir' effect is mainly responsible for the load support in deep grooves. There exists a value for groove depth beyond which the profile of the groove is no longer important to the pressure generation. The dimpled specimens exhibit a strong dependence on speed, a phenomenon that may be attributed to turning of the fluid in the direction transverse to the flow. This turning causes regions of high pressure to form symmetrically about the centerline of the dimple. Higher speed, higher inertia fluid would necessitate a higher pressure buildup to generate the turning motion.