D. F. Wilcock[2]

This paper provides a welcome addition to the available experimental data on tilting pad thrust bearings. Particularly useful is the author's demonstration of the lack of correlation between oil outlet temperature and bearing pad temperatures. The simplicity of a relationship between the two has tempted machine designers and users for many decades, and still does, despite analytical and experimental studies that have shown the contrary. Tilting pad thrust bearings are particularly subject to this lack of correlation since lubricant flow is not controlled by the bearing geometry but by inlet orifices or outlet seals.

The value of experiments of the type reported would be very significantly increased, from an engineering point of view, if some critical measurements were added. In particular, film thickness at several points on a pad, and circumferential force on a pad, would permit comparison with some of the analytical predictions which should be available to the authors. They could then begin to quantify the churning losses in a type of bearing which is designed to run immersed in lubricant, a loss which is becoming increasingly important as bearings are run at higher Reynolds' numbers in large power machinery.

W. W. Gardner[3]

As portions of this paper present tilting pad thrust bearing operating data from the same bearing test facility as that used for the tests reported in LubS-7 (a companion paper at this conference), several of my comments there apply here also, but will not be repeated. The data presented in this paper on two additional bearing sizes of similar geometry and construction adds to the field of knowledge in this specialized area and will aid in the design of machinery using such bearings.

The instrumentation of the 267 mm (10½ in.) bearing is noted to include proximity probes, presumably for film thickness measurements. The effects of turbulence on bearing temperature and power loss are presented. In this respect, would the authors comment on what corresponding effects were noted in film thickness measurements?

The data presented in Figs. 6 and 7, comparing pad temperatures at various locations on the pad face, are helpful in establishing a location for one thermocouple in a pad (as often done in bearing applications) as a monitor on bearing operation. The discusser is familiar with test data on similar type bearings, but at lower speeds (laminar operation) where the temperature at location #5 of Fig. 2 increased rapidly and to a level higher than that at location #4 just prior to bearing failure. This does not appear to be the situation in Figure 6, although the extent to which the load could be increased without failure is not known. Can the authors expand on this point in view of their test results?

Authors' Closure

The comments of Dr. Wilcock and Mr. Gardner regarding the content of this paper are appreciated by the authors. Unfortunately, space limitations would not permit the inclusion of all the data collected during these bearing tests. Measured oil film thickness values were omitted because the proximity probes were used only for the 267 mm (10½ in.) bearing tests so that comparison of the two different bearing sizes was not possible. In general, the data available for the 267 mm bearing shows no detectable increase in film thickness due to the onset of turbulence, although the anticipated variations with shaft speed and applied load are readily apparent. No measurements of actual pad circumferential force, as such, were made in either test program.

The phenomenon of peak pad temperature occurring at pad center (location #5) just prior to failure as described by Mr. Gardner was not encountered during this series of tests. The measured peak pad temperature was always closer to pad trailing edge than pad center. However, it is apparent from the data presented in this paper that the actual location of the peak pad temperature is dependent on the load and speed parameters, and it will change as the operating conditions are varied. It is entirely possible that a heavily loaded pad will crown sufficiently to force the peak temperature location back to the pad center (location #5) just before failure.

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