

Additional References

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Authors' Closure

The author's wish to thank Professor Braun for his comments and relevant questions. The following is a clarification of the different points he raised:

1. For a well lubricated bearing, the temperature in the stationary solid is expected to reach a steady state after running for a period of time. This is confirmed by the experiments performed by one of the authors [3] and by other investigators in the absence of forced cooling. At that point the journal can be treated adiabatically since the oil becomes the main vehicle of removing the heat generated in the bearing. In order to speed up the computation for reaching steady state in the journal with a transient model for the film, the adiabatic assumption is used from the onset. The initial phase of the computation will not be accurate but the steady state pressure will be accurate and can be reached in a very short computational time.

2. The consideration of cavitation, film rupture and reformation has been intentionally neglected in the reported study since we found that their influence on the resulting pressure to be very small in the considered cases. The computed maximum temperatures and shear zone thickness were relatively low to warrant undue concern about the development of vaporous conditions. Ignoring cavitation is therefore a realistic and practical assumption in order not to introduce additional model complexity or to distract from the main consideration in the paper which is the *assumption of a thin shear zone and the very significant effect of the thermal expansion across the film*. The latter effect has not, to the best of our knowledge, been previously treated and all other effects appear to be of secondary importance in bearings running with ample supply of oil.

3. The model used has 61×11 grid points for each layer in the sliding direction and across the film, respectively. The total number of points is approximately two thousand for the entire film which was found to be more than adequate for accurate computation. Further refinement of the grid did not change the results in the worst case.

4. An extensive study was undertaken based on the analysis presented in this paper to develop a *predictive* relationship for calculating the thickness of the shear zone. The analysis in all cases showed excellent correlation with pressure measurements from extensive tests on fixed geometry journal bearings (with eccentricity ratios varying from .6 to .9 and speeds of up to 2000 rpm) with different oils (SAE 5 to SAE 50) at different inlet temperatures. A report on this study will be given in a future paper.

5. The statement in question which was in the first draft in the paper referred to textbook procedures for the design of bearings. It certainly was not intended to imply that no research publications exist which deal with non-isothermal bearing problems. The sentence was nonetheless deleted in the final manuscript in order to avoid any unnecessary confusion.