DISCUSSION

M. Fillon

This study is an extension of previous works realized by Khonsari et al. for the fully circular journal bearing and by Fillon et al. for the tilting-pad journal bearing. The method, based on two dimensionless parameters, is applied successfully to the two-axial groove circular bearing. Nevertheless, in the first studies, the ISOADI model is employed for the generalization of the thermohydrodynamic predictions. The principal advantages of this modelization are the low number of the parameters and the conservative prediction of temperatures.

Why do the authors use CFD techniques for the generalization of the thermal predictions? What are the advantages of this modelization which requires a large number of parameters (material characteristics, ambient temperature, heat transfer coefficients . . .)?

Authors' Closure

The authors thank Professor Fillon for his comments and acknowledge that interesting points for discussion have been raised. Due reference was made in the paper to the previous works of Khonsari et al. (1995) and Fillon and Khonsari (1995) who dealt with the fully circular and tilting pad bearings, respectively. The extension of the present paper should be interpreted in terms of the following:

(a) The use of CFD techniques.
(b) The complete use of solid component external boundary conditions.
(c) The analysis of a two-groove bearing.

The discussion comment that the use of an ISOADI model leads to a reduced parameter list and conservative temperature predictions cannot be denied. However, the use of CFD techniques is not the reason for the increased number of parameters. The same parameters could have been included in a thin film formulation and, vice versa, an ISOADI based CFD model could have been derived. The use of a more accurate model, as assumed with CFD, must be accompanied with improved boundary conditions if advances in knowledge are to be made. ISOADI conditions limit analysis across the oil boundaries, whereas the limitations in the present paper are transferred to external bush and journal surfaces. The boundary conditions include typical values of heat transfer coefficients. It is argued that the predictions are only weakly dependent on these parameters at the external surfaces. If a bearing has heat transfer coefficients that are well above those used to produce the design curves, the predictions will be conservative. There will be other cases when the design predictions are in error, as when the perturbations from the typical data are large. Such cases are considered in the paper where comparisons are made with published experimental work. It is important to realize that these errors arise from the restriction of the design curves to variations of $k_1$ and $k_2$ only. The CFD approach could have been applied to each specific problem. Other reasons for the use of CFD techniques include:

(i) The avoidance of lumped parameter modeling across a groove by allowing for nontrivial radial flows.
(ii) The formulation in terms of generalized flow and heat transport allows general bearing models to be developed, though at the expense of increased computational effort.
(iii) Improved cavitation modeling is possible, though this did not form a major component in the present paper.
(iv) Dynamic conditions which cause thin film assumptions to fail may be modeled.