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DISCUSSION

J. W. Kannel[1]

Dr. Gupta has done a commendable job in constructing his roller bearing analysis program. In many regards, a roller bearing is more complicated than a ball bearing and incurs its own unique problems. I have only two general comments about the simulation model.

(1) The roller flange forces are critical to high speed bearing operation. I was hopeful that the author's model would show some new insight into this problem. However, it appears that his treatment of the roller flange interactions is overly simplified. I seriously doubt that this interaction can be represented by a Hertizian contact except in very special cases. This point of contact needs serious attention and hopefully more sophisticated treatment will be available in the future. I was also disappointed that more plots of flange load were not presented.

(2) Most of the authors analyses are accomplished with very sophisticated mathematics. However, the drag force estimate appears to be just a ball-park estimate. Yet, in the computations, this force is one of the dominate forces in affecting the authors torque calculations. It would seem that there should be a better way to calculate lubricant churning loss. In addition, in high-speed bearing tests, very high torques have been experienced. It is hard to believe that the dominate source of these torques is due to lubricant churning. Would the author comment on torque magnitude? Also, what are the units on Fig. 9 and Fig. 15?

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Author's Closure

Both comments made by Kannel are quite valid and are well accepted. The roller/flange interaction is indeed a fairly complicated area and the analysis presented in the paper is expected to be reasonable only when such interactions are relatively moderate as will be the case with cylindrical roller bearings operating with little or no misalignment. The analysis presented in the paper should therefore be viewed only as a starting point until more up-to-date treatment becomes available. The author hopes to provide a dynamic model for tapered roller bearings, in the near future, and as a part of that the roller/flange interaction model will be improved becuase this interaction is extremely important in tapered roller bearings.

Lubricant churning is another area where extensive research is necessary. In high-speed jet engine type bearings, churning is very important and the overall simulations of the bearing behavior is incomplete without a realistic model for such effects. The objective of the present investigation was to model the dynamics of the bearing and come up with a computerized simulation to study the importance of the various operational and geometrical parameters. The results show that the churning moments and drag losses, based on the existing order of magnitude type formulae, are significant and hence a much more sophisticated modelling of these interactions will be valuable input to the DREB computer program.

All the results presented in the paper are in dimensionless form and proper magnitudes can be obtained in terms of the fundamental units given under Table 1.

