theory [27] and X-ray data [33]. This is due to the difference in magnitude of (G). In general the two methods of testing have the same scatter from the suggested theory, Fig. 5.

Conclusions

The minimum oil film thickness is decreased with the increase of applied loads. With increasing the skew angle, i.e., increasing sliding to rolling speed ratio and ellipticity parameter, the minimum film thickness decreases with the load being kept constant.

EHD thermal solutions come in better agreement with present minimum oil film thickness measurements, however exact conformity is unattainable due to either different contact conditions assumed in theory or the assumptions involved in predicting EHD behavior.

References


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The authors are to be congratulated for their excellent work. Studying an EHD circular or elliptical contact using capacitive methods is rather tricky as the size of the capacitive element has to be small enough so that the averaging effect can be kept to a minimum. On the other hand a very small capacitive pad will provide a very low signal level. The authors appear to have solved the problem well.

The discusser's have also used a capacitive method (35) (rate of change of capacitance method initially used by Crook [36]) to study the deformation profile and film thickness in an EHD line contact. Synchronized pressure and film thickness sensors were developed to monitor both parameters simultaneously. It may be of interest to study some of the results obtained. Figure DI shows the output signals from such a pair of transducers. These pairs of profiles show the constriction zone to have occurred immediately after the secondary pressure peak. Some of the capacitive outputs also show the slight increase of oil film thickness prior to the constriction zone. To interpret the capacitive profiles into deformation profiles, one needs to know the dielectric constant of the lubricating oil being used under various pressures. This was done by measuring the capacitance of a capacitor formed between two parallel plates separated by the test oil under pressure in a hydrostatic pressure vessel. This correlation was applied to the capacitive signal using the accompanying pressure profile.

The deviation of the oil film thickness from the isothermal prediction under various operating conditions was also noticed by the discusser's. At low surface velocity and low load...
the minimum oil film thickness came close to the prediction under pure rolling conditions, but with the increase of the surface velocity it failed to increase as rapidly as the isothermal theory predicts. In the isothermal theory the value of the index $n$ in $h \propto (\eta_0 U)^n$ is about 0.7 whereas our results showed a value of around 0.5. One cause of the discrepancy could be the inlet shear heating which may occur so near to the contact region that it is impossible to monitor using conventional methods. Thin film temperature transducers made it possible to measure this temperature rise in the inlet region. In Fig. D2 a set of minimum oil film thickness results is plotted where the value of $\eta_0$ is corrected using the temperature monitored by the temperature transducers. The value of $n$ improves to 0.6 and 0.67 if correction is applied using temperature monitored at a distance of 2a and 1.5a, respectively, from the centre of the contact towards the inlet. Some of the experimental results without such correction are also plotted against the thermal loading parameter as shown in Fig. D3, along with March and Wilson's predictions. The faster reduction of the minimum of film thickness at high loads can be seen clearly from this plot.

Additional References

Authors' Closure
The authors would like to thank Dr. Safa and Dr. Macpherson for their comments and think that their discussions represent useful addition to the present work.