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The influence of cam-follower motion on elastohydrodynamic film thickness

R.P. Glovnea ... H.A. Spikes

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During operation, cam-follower contacts experience a complex combination of cyclically-varying speed, load and geometry. In practical terms, the variation in speed is particularly significant, since it results in a large variation of both entrainment and sliding velocity with a corresponding variation of elastohydrodynamic film thickness and friction. At some points in the cycle the entrainment velocity and thus the theoretical, steady-state film thickness falls to zero.

In most cam performance analyses, elastohydrodynamic film thicknesses are determined from steady state film thickness equations, with no account being taken of possible acceleration or squeze effects. The aim of the current paper is to test the validity of this approximation.

To do this, cam-follower kinematic cycles are simulated to a partial extent in a model ball on disc, optical interferometric test apparatus. Elastohydrodynamic film thickness is measured round the cycle using a combination of ultra-thin film interferometry and a

measured found the cycle using a combination of ultra-thin film interferometry and a high-speed, solid-state camera, to obtain high accurate film thickness measurements at 1 ms intervals. No attempt is made to vary the load and the contact radius and this represents the major simplification of the full cam-follower problem.

The results show that the central film thickness departs consistently from the predicted, steady-state value at some points in the operating cycle, which indicates that squeeze effects play an important role in the lubrication of this type of mechanism. It also was found that a finite lubricant film was retained even in the positions where the entrainment speed fell to zero.

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