

THE INFLUENCE BOUNDARY LUBRICATION AND ELASTICITY ON THE UNIT WEAR EVENT

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ABSTRACT

When a hard two-dimensional asperity is dragged across a softer surface so that there is significant plastic deformation, the geometry is often idealised as an oblique angled wedge and the boundary lubricated interface as possessing a strength which has some fixed proportion of the flow stress of the adjacent weaker material. Real asperities are, however, more likely to have somewhat rounded summits with radii of curvature which are comparatively large compared to the scale of the deformation taking place. In addition, it is known that the mechanical properties of boundary layers are invariably sensitive to the locally generated pressures. In this contribution the slip-line field developed by Challen and Oxley et al is presented in a form appropriate for locally cylindrical asperities and is combined with an interface between the asperity and the deforming material which exhibits a shear strength which is a known function of the local interfacial pressure. As the attack angle presented by the model asperity reduces to realistic values then so the elastic contribution to deformation becomes increasingly significant and the simplifications inherent in any slip line field solution less tenable. This factor is also examined and the way in which the elasto-plastic regime may be mapped out in appropriate coordinates is indicated.

keywords: friction, boundary lubrication, elasticity, plasticity