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# The Effect of Adhesion on the Frictional Hysteresis Loops at a Rough Interface

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**Abstract :** Frictional hysteresis is the phenomenon in which mechanical contacts are subject to small (compared to contact area) oscillating tangential displacements. In the presence of adhesion at the interface, the contact repulsive force increases leading to a higher static friction force and pre-sliding displacement. This paper proposes a boundary element model (BEM) for the adhesive frictional hysteresis contact at the interface of two contacting bodies of arbitrary geometries. In this model, adhesion is represented by means of a Dugdale approximation of the total work of adhesion at local areas with a very small gap between the two bodies. The frictional contact is divided into sticking and slipping regions in order to take into account the transition from stick to slip (pre-sliding regime). In the pre-sliding regime, the stick and slip regions are defined based on the local values of shear stress and normal pressure. In the studied cases, a fixed normal force is applied to the interface and the friction force varies in such a way to start gross sliding in one direction reciprocally. For the first case, the problem is solved at the smooth interface between a ball and a flat for different values of work of adhesion. It is shown that as the work of adhesion increases, both static friction and pre-sliding distance increase due to the increase in the contact repulsive force. For the second case, the rough interface between a glass ball against a silicon wafer and a DLC (Diamond-Like Carbon) coating is considered. The work of adhesion is assumed to be identical for both interfaces. As adhesion depends on the interface roughness, the corresponding contact repulsive force is different for these interfaces. For the smoother interface, a larger contact repulsive force and consequently, a larger static friction force and pre-sliding distance are observed.

**Keywords :** boundary element model, frictional hysteresis, adhesion, roughness, pre-sliding
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