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On the role of adhesion and roughness in stick-slip transition at the contact of two bodies: a numerical study

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Abstract:

This paper proposes a boundary element model for the stick-slip transition at the contact of two bodies of dissimilar materials in presence of adhesion due to van der Waals force. The adhesion is modeled using a Dugdale approximation of adhesive energy. The coupling between the normal pressure and shear stresses is included so that there is no full-stick condition, even in the absence of an external shear stress. Furthermore, the evolution of the slip area over the contact area is different from the well-known Cattaneo-Mindlin solution due to the difference in the mechanical properties of the contacting bodies. It is also shown that the adhesion increases the pre-sliding distance and the static friction. While roughness can only increase the former one. However, the combined effect of roughness and adhesion on the pre-sliding distance is not cumulative as these two parameters are found to be symbiotic.

Keywords: Stick-Slip, Adhesion, Roughness

1. Introduction

When two surfaces in contact are tangentially loaded by a force smaller than the force required to cause a gross sliding (here named the static friction force), surface strains are not uniformly

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