A multiscale contact homogenization technique for the modeling of third bodies in the contact interface

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Comput. Methods Appl. Mech. Engrg. , 198: 377-396, 2008

Abstract

In this work, a contact homogenization technique is developed to extract the macroscopiccoefficient of friction (CF) from a three-body frictional system. The particularfrictional system under consideration consists of rigid particles embedded between a finitely deformable elastic solid and a rigid surface. The challenge of the problem lies in modeling the interaction between the particles with the finite element mesh, as well as in the dynamic nature of the problem. In order to extract the macroscopic CF, a microscopic sample is analyzed in a time-adaptive dynamic setting and the macroscopic CF is identified as theratio of tangential force to normal force applied to the sample. In order to alleviate dynamic effects, time averaging is employed. The identification of a representative contact element (RCE) and the application ofproper boundary conditions are discussed for periodic and random arrangements of theparticles in the interface with a particular emphasis on the nature of the micro-to-macrotransition procedure. Finally, the implementation of the model in a coupledmicro2̆013macro simulation using a RCE is discussed in the context of multiscale analysis.

The complete document can be found here.