Stiffness of Contacts of Self-Affine Surfaces

TRISTAN A. SHARP, MARK O. ROBBINS, SREEKANTH AKARAPU, Johns Hopkins University — The presence of roughness on a wide range of scales has a profound effect on the contact area and interfacial stiffness between contacting surfaces. In turn, the interfacial stiffness dominates the response of many macroscopic systems. Molecular dynamics simulations are used to characterize contacts between self-affine fractal surfaces with different roughness exponents. A unified framework describes the relation between roughness, system size, surface separation, stiffness, and contact area for a wide variety of systems. The contact area and normal stiffness rapidly approach Persson’s continuum theory with increasing system size [1]. The lateral stiffness and friction are much more sensitive to atomic-scale effects. Atomic scale displacements at the interface can greatly reduce lateral stiffness and may explain the low lateral stiffness observed in some experiments.


This material is based upon work supported by the Air Force Office of Scientific Research under Grant No. FA9550-0910232