

FINITE ELEMENT ANALYSIS OF ADHESIVE CONTACT OF THE WEIERSTRASS PROFILE

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KEYWORDS

Adhesion, Rough surface, Contact

ABSTRACT

Adhesive contact of a rigid flat surface with an elastic substrate having Weierstrass surface profile is numerically analysed using the finite element method. In this work, we investigate the relationship between load and contact area spanning the limits of non-adhesive normal contact to sticky contact for various substrate material properties, adhesive strength and roughness parameters. In the limit of non-adhesive normal contact, our results are consistent with (Ciavarella et al. 2000 Proc. R. Soc. Lond. A 456, 387-405 and Hyun et al. 2004 Phys. Rev. E 70, 026117) - contact area is linear with load and has a fractal character. For the adhesive contact problem, we employ Lennard-Jones type of interaction model with numerical regularization to resolve unstable pull-off. We study the transition from full contact to partial contact and the scaling of pull-off force with non-dimensional parameters to quantify the effect of roughness parameters, substrate material properties as well as adhesive strength and range.

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