Modeling metal plasticity induced by contact loading

Syam Venugopalan[†], Lucia Nicola*[†]

[*] Department of Industrial Engineering
University of Padua
Via Venezia 1, 35131 Padova, Italy
e-mail: lucia.nicola@unipd.it

[†] Department of Material Science and Engineering
Delft University of Technology
Mekelweg 2, 2625 Delft, the Netherlands
email: l.nicola@tudelft.nl

ABSTRACT

Metal surfaces are characterized by roughness with wavelengths spanning various orders of magnitude. When modeling the contact behaviour of metal bodies, it is critical to describe the roughness with great accuracy, since important tribological quantities depend on it. While elastic contact between rough surfaces has been modelled extensively in recent years, less attention was devoted to plastically deforming contacts. Here, we present a study of the plastic deformation of a rough metal body in contact with a rigid flat [1].

The simulations aim at being accurate both in the description of plasticity and in the description of the roughness and the evolving contact. To this end, plasticity is modelled by means of dislocation dynamics [2], the image fields are computed through Green's function molecular dynamics [3].

Results of the simulations show that the plastic response of the rough metal bodies, differently from their elastic response, depends on root-mean-square height. Also, the mean contact pressure is significantly larger than what predicted through classical plasticity simulations.

Results are then compared with Persson's contact mechanics theory

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