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CONTACT MECHANICS OF SOFT MATTER: INFLUENCE OF SURFACE TENSION

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In the last decade, the influence of surface tension on contact properties has attracted much attention, especially in the context of contact of very soft materials (like gels) or contacts at the nanoscale. However, in the most current studies it is assumed that the tension of the surface inside and outside the contact area is the same. This practically means that the considered object is an elastic body "coated" with a tensed membrane. In real contacts, there is no reasons why the surface tension of the "free interface" and the "contact interface" should be equal. On the contrary, especially in contacts of soft bodies with hard solid indenters one can await that they are completely different. In the present paper, we consider an elastic contact with account of different surface tension inside and outside the contact area. However, the first class of contacts, which is considered here, are still "non-adhesive" contact. This means that the interface surface energies of the three interfaces meeting at the contact boundary fulfil the criterion that the work of separation vanishes. A numerical model based on the FFT assisted BEM is implemented and is illustrated with a few examples.

Even more confusion reigns at the present the problem of adhesive contact with account of the surface tension inside and outside the contact area. We show that that the boundary condition for the surface outside the contact area is given by the constant contact angle – as in the case of fluids in contact with solid surfaces. We implement the equations of elasticity and the above boundary condition into a Boundary Element Program and consider a series of contact problems with bodies of different shape, both smooth and rough.