Rolling/sliding contact of the coated bodies

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Different types of the friction contact of coated bodies are the subject of this study. For the case of elastic interaction the contact pressure and stresses inside the coating-substrate system depend on contact normal and tangential forces and the following parameters:

- Geometry parameters (the shape of the contact bodies and the coating thickness)
- Elasticity parameters of the coating, the substrate, and the counter body
- Friction parameters

Rolling and sliding contact of an axisymmetric punch and two-layered elastic half-space is considered, and the dependence of the problem solution on the parameters is analyzed.

The rolling contact of a ball and a coated body is studied by the methods of contact mechanics. The coated body is considered as a two-layered elastic foundation. It has been assumed that normal contact stresses don't depend on surface tangential stresses. The axisymmetrical contact problem is solved by the method based on Hankel integral transforms. Variation method is used to find stick-slip zones and the distribution of tangential forces. The method has been distributed originally for homogeneous elastic bodies. For this study it have been extended and used for the contact of two-layered bodies. Internal stresses are calculated by boundary elements method using double Fourier transforms for stress determination under each surface element. The method is realized for the following contact bodies: ceramic ball and steel trench with hard coating. The coating elastic modulus is 2.5 greater than the steel modulus. For the production range of coating thickness (1-3 μm) different values of the normal load are considered.

The sliding contact of an axisymmetric punch and a two-layered elastic half-space is considered taking into account the punch roughness. The problem is solved by two steps. First the frictionless contact of the punch with elastic layer is considered. The roughness is modelled by one-level system of smooth axisymmetric asperities. The periodical contact problem is solved taking into account mutual effect; for the system the function of additional displacement is obtained. This function is used to find contact pressure distribution under the punch. This part of the study is carried out by the method based on Hankel integral transforms; the results are calculated using boundary element method and the iteration procedure. The contact pressure distribution is used to obtain stresses inside the elastic layer and the foundation taking into account friction. The contact and internal stresses are analysed for hard and soft coatings and different values of friction coefficient.

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