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Adhesive Component of the Rolling Friction Force

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Adhesive component of the rolling friction force is calculated by using the model of a cylinder rolling on the boundary of the elastic base. When the cylinder rolls, each asperity approaches the base and then moves away from it. In each approach-separation cycle, the energy dissipation takes place. It is assumed that the total energy dissipation produced by all asperities is equal to the work of the friction force. To calculate the energy dissipation in an elementary approach-separation cycle for a separate asperity, contact problems are considered and solved taking into account two types of adhesion: capillary adhesion of surfaces covered by fluid films and adhesion of dry surfaces. The friction force is calculated depending on the surface energy of the bodies, surface tension and volume of fluid, mechanical properties of the base, normal load applied to the cylinder, shape of aspeirties and their height distribution.

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