Three-dimensional Prandtl-Tomlinson model of nanoscale friction

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ABSTRACT: Friction is a complex phenomenon that involves interaction between micro-sized asperities on the surfaces of two bodies in contact. The Prandtl-Tomlinson model of single-asperity friction is developed that fully incorporates the three-dimensional character of the problem. An algorithm is derived that allows integrating the resulting equations of motion. The effect of periodic actuation of the AFM cantilever on the resulting friction forces is studied within this model. The dependence of friction force on actuation frequency at fixed amplitude and on the actuation amplitude at fixed frequency is obtained numerically. Finally, the limitations of the model are discussed.

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