Abstract Submitted
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Measuring contact area at the nanometer scale[1] SHENGFENG CHENG, MARK ROBBINS, Department of Physics and Astronomy, Johns Hopkins University — The real area of contact between surfaces A_{real} plays a central role in macroscopic theories of friction, which often assume friction is proportional to A_{real}. The meaning of contact and A_{real}, as well as their connection to friction, become unclear when considering atomic interactions at nanometer scales. We use molecular dynamics simulations to compare and contrast different definitions of contact. The geometries considered include a flat or rough elastic substrate and a rigid surface that is flat or spherical. Both adhesive and non-adhesive interactions are considered. Contact area is measured by counting atoms within some cutoff distance or from the time averaged pressure on the opposing surfaces. The effects of cutoff distances or pressure thresholds, temperature, load, and measurement time are described. Many definitions lead to undesirable results, such as strong load dependence of A_{real} between atomically flat surfaces. These results are related to the statistical distributions of contact times and probabilities, which exhibit a surprisingly universal dependence on the mean force at each temperature.

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