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Mechanical properties of graphene on deformable patterned substrates: Theoretical model D.Z. ROCKLIN, R. WEAVER, S. SCHARFENBERG, C. CHIALVO, N. MASON, P.M. GOLDBART, University of Illinois —
Recent experiments, reported in an accompanying paper, have addressed the consequences of depositing samples of few-layer graphene (FLG) on to a rubbery substrate patterned with microgrooves of amplitude $\sim$100 nm and wavelength $\sim$1 μm. The results of these experiments suggest that the graphene entirely adheres to the substrate, following the contour of its surface and causing a substantial flattening of the grooves (i.e., a reduction in the amplitude of the groove profile). We present a theoretical model based on linear elasticity theory that describes composite graphene-substrate systems. By analyzing the experimental data in terms of this model we are able to characterize the behavior of the FLG, and to place bounds on the adhesion strength between graphene and the polydimethylsiloxane substrate as well as on the shear strength between the layers of graphene.

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