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Mechanics of Flow over Wrinkled Surfaces SHABNAM RAAYAI, GARETH MCKINLEY, Massachusetts Inst of Tech-MIT, MARY BOYCE, Columbia University — The surfaces of many plants and animals are covered with a variety of microtextures such as ribs or 3D tubules which can control surface-mediated properties such as skin friction. Inspired by the drag reducing ability of these natural structures, passive drag reduction methods such as microfabricated riblet surfaces have been developed. Microgroove textures on the surface of objects such as hulls and wings which are aligned in the free-stream direction have been shown to reduce drag by 4-8% in flows with zero or mild pressure gradients [1]. We introduce sinusoidal wrinkles as model ribbed surfaces with drag reducing capabilities. Surface wrinkling arises spontaneously as the result of mismatched deformation of a thin stiff coating bound to a thick soft substrate and can be designed over a wide range of length scales. Using numerical modeling we show that wrinkled surfaces can substantially reduce the skin friction coefficient in high Reynolds number laminar flow. We show that this reduction is a result of purely viscous mechanisms through a geometry-mediated increase in the thickness of the boundary layer and retardation of the flow in the interstitial grooves of the textured surfaces.

[1] D. Bechert *et al.*, Experiments in Fluids **28** (2000)

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