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Effective slip identities for viscous flow over arbitrary patterned surfaces KEN KAMRIN, MIT, PIERRE SIX, Ecole Nationale Superieure des Mines de Paris — For a variety of applications, most recently microfluidics, the ability to control fluid motions using surface texturing has been an area of ongoing interest. In this talk, we will develop several identities relating to the construction of effective slip boundary conditions for patterned surfaces. The effective slip measures the apparent slip of a fluid layer flowing over a patterned surface when viewing the flow far from the surface. In specific, shear flows of tall fluid layers over periodic surfaces (surfaces perturbed from a planar no-slip boundary by height and/or hydrophobicity fluctuations) are governed by an effective slip matrix that relates the vector of far-field shear stress (applied to the top of the fluid layer) to the effective slip velocity vector that emerges from the flow. Of particular note, we will demonstrate several general rules that describe the effective slip matrix: (1) that the effective slip matrix is always symmetric, (2) that the effective slip over any hydrophobically striped surface implies a family of related results for slip over other striped surfaces, and (3) that when height or hydrophobicity fluctuations are small, the slip matrix can be approximated directly using a simple formula derived from the surface pattern.

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