Shear flow over arbitrary periodic surfaces KEN KAMRIN, Harvard, HOWARD STONE, Princeton, MARTIN BAZANT, MIT — In a variety of applications, notably microfluidics, slip-based boundary conditions have been sought to characterize fluid flow over patterned surfaces. This work focuses on shear flows of Stokes fluid over surfaces with small height fluctuations and/or fluctuating Navier slip properties. Our goal is to derive a general formula to determine the "effective slip" in terms of surface properties and the applied shear stress. We show that the slip and the applied stress are always related linearly through a slip matrix, representing a tensorial mobility. The method of domain perturbation is then used to deduce an approximate formula for the slip matrix. We use the formula to determine optimal surface shapes and the effect of random fluctuations on fluid slip.

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