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The Effects of Geometry and Wetting on Fluid Flow in Microchannels with Superhydrophobic Walls: A Numerical Study TODD SALAMON, WONSUCK LEE, TOM KRUPENKIN, MARC HODES, PAUL KOLODNER, Bell Labs, Lucent Technologies, ANDREW SALINGER, Sandia National Labs, RYAN ENRIGHT, Univ. of Limerick — Superhydrophobic surfaces combine roughness and chemical treatment to increase the hydrophobicity of a surface. The enhanced drag reduction (Ou *et al.,* 2004) exhibited by these surfaces suggests that they may provide an enabling technology for reducing microchannel flow resistance. In this work, a finite element analysis is used to study the fully-developed, three-dimensional laminar flow of a Newtonian fluid in a microchannel with superhydrophobic walls consisting of an array of square posts with uniform post-to-post pitch. The effects of post size, pitch, channel height and wetting on the flow field and corresponding flow enhancement are presented. Examples illustrating insight gained from the simulations include: i) for small values of the post size and pitch relative to the channel height, the axial velocity field away from the superhydrophobic channel walls is well described by the analogous two-dimensional channel flow with Navier's slip law applying at the channel wall and an apparent slip coefficient determined from the calculated flow enhancement; and ii) wetting of the fluid into the post structure dramatically decreases the calculated flow enhancement.

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