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A priori models for predicting drag reduction for flow over heterogeneous slip boundaries MARGARET HECK, DIMITRIOS PAPAVASSILIOU, University of Oklahoma — Slip at fluid-fluid/fluid-solid interfaces is a subject of interest for many engineering applications, ranging from porous materials to biomedical devices to separation processes. Despite remarkable effort to include the effects of surface topology and various flow and physical properties in models describing fluid slip, the mathematical description of flow over mixed slip boundaries is still under investigation. Using similarity theory, which is based on the generalized homogeneity of physical laws governing most systems and takes advantage of similarity in the spatial distribution of characteristics of motion, the equivalent slip velocity is shown to be a function of the geometry of a microfluidic system. The results are used to predict the slip velocity for flow over surfaces with periodically repeating no-slip/free-shear boundaries in the shape of rectangles for 16%-50% solid fractions. The equivalent slip velocity for flow over rectangular boundaries can then be related to the those for flow over surfaces with square and circular no-slip boundaries using characteristic length ratios. The models developed using this apporach can be directly used to estimate the slip velocity for flow over various free-shear/no-slip boundaries for Couette, laminar flow conditions.

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