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Effective Medium Theory for Drag Reducing Micro-patterned Surfaces in Turbulent Flows ILENIA BATTIATO, Clemson University — Inspired by the lotus effect, many studies in the last decade have focused on micro- and nano-patterned surfaces. They revealed that patterns at the micro-scale combined with high contact angles can significantly reduce skin drag. However, the mechanisms and parameters that control drag reduction, e.g. Reynolds number and pattern geometry, are still unclear. We propose an effective medium representation of the micro-features that treats the latter as a porous medium, and provides a framework to model flows over patterned surfaces in both Cassie and Wenzel states. Our key result is a closed-form expression for the skin friction coefficient in terms of frictional Reynolds (or Karman) number in turbulent regime. We apply the proposed model to turbulent flow over superhydrophobic ridged surfaces. The model predictions agree with laboratory experiments for Reynolds numbers ranging from 3000 to 10000.

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