

Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Effective medium theory for drag-reducing micro-patterned surfaces in turbulent flows ILENIA BATTIATO, San Diego State University — Many studies in the last decade have revealed that patterns at the microscale can reduce skin drag. Yet, 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 turbulent flow over patterned surfaces. Our key result is a closed-form expression for the skin friction coefficient in terms of frictional Reynolds (or Karman) number in turbulent regime, the viscosity ratio between the fluid in and above the features, and their geometrical properties. We apply the proposed model to turbulent flows over superhydrophobic ridged surfaces. The model predictions agree with laboratory experiments for Reynolds numbers ranging from 3000 to 10000.¹

¹Battiato, I., Eur. Phys. J. E (2014) 37: 19 DOI 10.1140/epje/i2014-14019-0

Ilenia Battiato
San Diego State University

Date submitted: 24 Jul 2014

Electronic form version 1.4