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Modeling superhydrophobic surfaces comprised of random roughness[1] M.A. SAMAHA, H. VAHEDI TAFRESHI, M. GAD-EL-HAK, Virginia Commonwealth University — We model the performance of superhydrophobic surfaces comprised of randomly distributed roughness that resembles natural surfaces, or those produced via random deposition of hydrophobic particles. Such a fabrication method is far less expensive than ordered-microstructured fabrication. The present numerical simulations are aimed at improving our understanding of the drag reduction effect and the stability of the air–water interface in terms of the microstructure parameters. For comparison and validation, we have also simulated the flow over superhydrophobic surfaces made up of aligned or staggered microposts for channel flows as well as streamwise or spanwise ridge configurations for pipe flows. The present results are compared with other theoretical and experimental studies. The numerical simulations indicate that the random distribution of surface roughness has a favorable effect on drag reduction, as long as the gas fraction is kept the same. The stability of the meniscus, however, is strongly influenced by the average spacing between the roughness peaks, which needs to be carefully examined before a surface can be recommended for fabrication.

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