ID 109

Aerodynamic Performance of Smooth Selectively Superhydrophobic Flat Plates: A Numerical Approach

VC Perera[1#] and SLMD Rangajeeva[1]

[1]Faculty of Engineering, General Sir John Kotelawala Defence University, Ratmalana, Sri Lanka

[#]37-eng-0054@kdu.ac.lk

Abstract

The interference to fluid flow over a solid surface is significantly high to such an extent that the fluid in contact with the surface possesses a null velocity. This phenomenon is called the no-slip condition. On the contrary, superhydrophobic surfaces possess significant slip velocities, hence a partial slip condition, enabling significant drag reduction properties when in relative motion with fluids. However, making a complete object superhydrophobic may not necessarily provide the most aerodynamic nor cost-effective solution. A smooth flat plate of 50% slip condition was used as the first step to link the relationship between superhydrophobic area and the drag coefficient using computational fluid dynamics software, OpenFOAM. A greater drag reduction was observed for partially superhydrophobic flat plates compared to a fully superhydrophobic counterpart. The flat plate was made superhydrophobic using five unique approaches in total, both unilaterally and bilaterally in either direction of the flat plate. It was then found that drag reduction did not arbitrarily depend on the total area of superhydrophobicity. Each approach resulted in a unique drag reduction trend with increasing superhydrophobic area. Superhydrophobising the flat plate from the trailing edge towards the leading edge, against the flow direction, provided the best drag reduction characteristics.

Keywords: *Superhydrophobic, Flat plate, Drag reduction*