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Thermal transport due to buoyant flow past a vertical, heated superhydrophobic surface with uniform stream-wise slip[1] MATTHEW SEARLE, DANIEL MAYNES, JULIE CROCKETT, Brigham Young University —
An analytical investigation of thermal transport due to a steady, laminar, buoyancy-driven flow past a vertical superhydrophobic(SHPo) surface was performed. The surface temperature was constant and uniform and exceeded the temperature of the surrounding liquid. Uniform stream-wise hydrodynamic slip and temperature jump are imposed at the wall to model the SHPo surface. Applying an integral analysis within the boundary layer results in a system of differential equations which are solved numerically to obtain boundary layer thickness, maximum velocity in the profile, and local and average values of both the friction coefficient and the Nusselt number. The classical smooth hydrophobic scenario with no-slip and no temperature jump showed excellent agreement with previous analysis of the same problem. The influence of varying temperature jump length on the local and average values of the friction coefficient and the Nusselt number was obtained for Rayleigh number ranging from 10^4 to 10^9 and Prandtl number ranging from 2 to 11. Local and average Nusselt numbers decrease dramatically, concomitant with a decrease in the maximum fluid velocity, as the temperature jump length increases.

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