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Drag Estimation of Isolated, Surface-mounted, Droplet-inspired Geometries XUEQING ZHANG, BURAK A. TUNA, SERHIY YARUSEVYCH, SEAN D. PETERSON, University of Waterloo — Droplet mobility on a substrate due to aerodynamic loading is of interest of many industrial applications. However, modeling this phenomenon is hindered by a lack of reliable estimations of aerodynamic forces on representative shapes. The present study investigates the wake development downstream of isolated, surface-mounted, three-dimensional droplet shapes submerged in a laminar boundary layer. The obstacle geometries considered are representative of the droplet morphologies at sessile state ('sessile') and at depinning ('runback'). The incoming flow has a Reynolds number based on obstacle height of $\mathrm{Re_h} = 2070$ and a boundary layer thickness of around one obstacle height, simulating the critical flow conditions at droplet depinning. Aerodynamic loading on the obstacles is estimated using the wake integral method extended to drag estimation for obstacles with high boundary layer submergence. With a laminar incoming boundary layer, the drag coefficient of the 'sessile' model is larger than that of the 'runback' model. The drag reduction for the 'runback' model is ascribed to the tapered front-body and short aft-body geometry, which makes the obstacle more aerodynamic. For both cases, drag coefficients decrease with increasing turbulence level in the incoming flow.

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