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A Three-dimensional Numerical Study of Immiscible Droplet Deformation in a right angle bend PURUSHOTAM KUMAR, JEREMY HORWITZ, SURYA VANKA, University of Illinois at Urbana-Champaign — We present a numerical study of deformation of an immiscible droplet in a right angle bend. We have used volume-of-fluid method to track the interface and variable density Navier-Stokes equations to solve for the flow field. A second-order accurate fractional step algorithm is used to integrate the equations. The VOF is also coupled to a level-set method to get a smoothed interface shape for surface tension calculations. We study the effects of density and viscosity ratios (between droplet and carrier fluids), Reynolds number, Capillary number and aspect ratio between droplet and duct size on the deformation characteristics. We investigate the elongation of the droplet in axial direction and the stretching or contraction of the droplet in the lateral direction. Depending on the value of above mentioned parameters droplet can take different shapes, namely, spherical, bullet and parachute. At moderately higher Reynolds numbers we also observe satellite droplet breaking from the original droplet.

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