Motion of a semi-infinite bubble in a liquid filled channel using the level set method[1] DENIZ TOLGA AKCABAY, University of Michigan, DAVID HALPERN, University of Alabama, JAMES B. GROTBERG, University of Michigan — The study of plug propagation in lung airways is of interest in the treatment of medical conditions such as asthma and in drug delivery. The problem of a semi-infinite bubble steadily displacing a liquid in a 2D channel (planar Bretherton problem) is computed using a fractional-step method on a Cartesian grid to solve the Navier-Stokes equations and a level-set formulation for resolving the air-liquid interface. We matched with available literature the geometry of the front and rear menisci of this semi-infinite bubble, stresses on the channel walls, and the maximum pressure drop as a function of the Capillary number – the ratio of viscous to surface tension effects. Furthermore, we present preliminary results for flows within tapered walls to address area expansion near airway bifurcations.

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