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Predicting apparent slip at liquid-liquid interfaces without an interface slip condition[1] PIETRO POESIO, ANGELO DAMONE, University of Brescia, OMAR MATAR, Imperial College London — We show that if we include a density-dependent viscosity into the Navier-Stokes equations then we can describe, naturally, the velocity profile in the interfacial region, as we transition from one fluid to another. This requires knowledge of the density distribution (for instance, via Molecular Dynamics [MD] simulations, a diffuse-interface approach, or Density Functional Theory) everywhere in the fluids, even at liquid-liquid interfaces where regions of rapid density variations are possible due to molecular interactions. We therefore do not need an artificial interface condition that describes the apparent velocity slip. If the results are compared with the computations obtained from MD simulations, we find an almost perfect agreement. The main contribution of this work is to provide a simple way to account for the apparent slip at liquid-liquid interfaces without relying upon an additional boundary condition, which needs to be calculated separately using MD simulations. Examples are provided involving two immiscible fluids of varying average density ratios, undergoing simple Couette and Poisseuille flows.

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Omar Matar
Imperial College London

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