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Reduced order modelling of counter-current two-layer flows[1] GIANLUCA LAVALLE, MATHIEU LUCQUIAUD, PRASHANT VALLURI, The University of Edinburgh — The dynamics of two-layer flows has a great impact on absorption units of carbon-capture retrofits, since the wavy interface plays a crucial role on the transfer between the two fluids. Studying those flows by a direct numerical simulation (DNS) strategy results in a high computational cost requiring parallel computation. As an alternative approach, we present a reduced order model: the liquid film is computed with depth-integrated equations, and the coupling with the top phase is obtained by means of the Arbitrary Lagrangian-Eulerian (ALE) technique, according to which the grid follows the interface position. We study counter-current two-layer channel flows with a moderate density ratio, focusing on loading and flooding regimes, whose complete description is a central issue for many chemical applications. Also, we investigate the influence of flow rate and pressure gradient on the interface dynamics. Speed and growth rate of linear waves match with the Orr-Sommerfeld theory and our Level-Set DNS, and non-linear wave profiles agree with DNS. Finally, our model is tested with complex gas velocity profiles of cross-flow absorbers.

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