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Direct numerical simulation of annular flows with surfactants¹ ANDRIUS PATAPAS, ASSEN BATCHVAROV, LYES KAHOUADJI, Imperial College London, JALEL CHERGUI, DAMIR JURIC, LIMSI, CNRS, SEUNGWON SHIN, Hongik University, Korea, RICHARD V. CRASTER, OMAR K. MATAR, Imperial College London — Vertical counter-current air-water surfactant-laden flows are investigated using direct numerical simulations. The computations are carried out using Blue, a front-tracking-based CFD solver. The presence of surfactants in the flow results in Marangoni stresses. At low gas and liquid flow rates, the Marangoni effect is found to be dominant over shear stresses, resulting in the suppression of wave perturbations and wave amplitudes. Marangoni stresses are found to dominate at low gas and liquid flow rates, resulting in lack of wave development and subsequent droplet detachment thus hindering flooding. It is also found that shear stresses dominate the flow at higher gas/liquid flow rates, "trapping surfactant in wave crests thus favouring droplet detachment and increasing the extent of flooding. In addition to the above, we also report on the results of a parametric study to observe the effect of varying surfactant surface concentration, maximum packing concentration, bulk and interface diffusivity, and adsorption and desorption rate on the interfacial dynamics.

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