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Non-linear single-wave Kelvin-Helmholtz instability in a channel[1]

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— A stratified viscous gas-liquid two-phase flow confined in a horizontal channel is studied, surface tension effects being included. Contrary to previous papers of literature, where a parallel flow configuration is classically analyzed with plug-velocity profile in both fluids, here the flow is spatially developing starting from a plug-plug profile at the channel entrance. The sudden change of interface boundary condition produces the flow development and the emergence of a solitary Kelvin-Helmholtz wave, whose formation and evolution, inherently non linear, are studied through numerical simulations based on the Volume of Fluid (VOF) technique. The amplitude growth rate and the propagation velocity of the wave at early instants agree closely with the predictions of a straightforward model. Later times simulations show the wave break-up in small droplets.

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