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Spatio-temporal evolution of interfacial instabilities in vertical gas-liquid flows PATRICK SCHMIDT, PRASHANT VALLURI, University of Edinburgh, LENNON Ó NÁRAIGH, University College Dublin, MATHIEU LUCQUIAUD, University of Edinburgh — Vertical gas-liquid flows are characteristic for process engineering and widely employed in various technical applications. However, the dynamic behaviour of the liquid interface in such flows is still not fully understood. We focus in our work on characterising the interfacial instability as well as associated interfacial waves in vertical laminar-laminar gas-liquid flows over a wide range of parameters covering different flow regimes, i.e. countercurrent, zero-interface velocity (loading) and partial-to-full liquid flow reversal (flooding). High-resolution direct numerical simulations using the TPLS flow solver (http://sourceforge.net/projects/tpls/) reveal the existence of weakly nonlinear interfacial waves, which are in good agreement with Stuart-Landau theory. These waves travel down- or upstream, depending on the flow regime. Furthermore, spatio-temporal linear stability analysis indicates the occurrence of absolute instability within the investigated parameter range. DNS is used to analyse this feature in more detail whereby agreement with linear theory has been established.

Patrick Schmidt
University of Edinburgh

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