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Direct numerical simulation of interfacial wave generation in turbulent gas-liquid flows in horizontal channels BRYCE CAMPBELL, KELLI HENDRICKSON, YUMING LIU, Massachusetts Inst of Tech-MIT, HARIPRASAD SUBRAMANI, Chevron Energy Technology Company — For gas-liquid flows through pipes and channels, a flow regime (referred to as slug flow) may occur when waves form at the interface of a stratified flow and grow until they bridge the pipe diameter trapping large elongated gas bubbles within the liquid. Slug formation is often accompanied by strong nonlinear wave-wave interactions, wave breaking, and gas entrainment. This work numerically investigates the fully nonlinear interfacial evolution of a two-phase density/viscosity stratified flow through a horizontal channel. A Navier-Stokes flow solver coupled with a conservative volume-of-fluid algorithm is use to carry out high resolution three-dimensional simulations of a turbulent gas flowing over laminar (or turbulent) liquid layers. The analysis of such flows over a range of gas and liquid Reynolds numbers permits the characterization of the interfacial stresses and turbulent flow statistics allowing for the development of physics-based models that approximate the coupled interfacial-turbulent interactions and supplement the heuristic models built into existing industrial slug simulators.

Kelli Hendrickson
Massachusetts Inst of Tech-MIT

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