Abstract Submitted
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Three-dimensional numerical simulations of three-phase slug flows in horizontal pipes[1] YAN WANG, JUNFENG YANG, OMAR MATAR, Imperial College London — One of the most common flow regimes in pipelines is that of slug flow: slug bodies corresponding to alternating blocks of aerated liquid which bridge the pipe, separated by elongated bubbles; the latter ride atop a liquid layer. The slugs travel at velocities that exceed the mixture superficial velocity; this can potentially cause structural damage, particularly at pipe bends and junctions. Two-phase slug flows have received considerable attention in the literature both experimentally and computationally but there has been very little work carried out on three-phase slugging. In the present work, the evolution of oil-water-air three-phase slug flow in a horizontal cylindrical pipe is investigated using two-dimensional and three-dimensional computational fluid dynamics simulations. The parameters characterising three-phase slug flow, e.g. slug length, propagation velocity, and slug formation frequency, are determined for various gas and liquid superficial velocities for a given pipe geometry. The results of this work are compared to available experimental data and numerical solutions based on approximate, one-dimensional models relying on the use of empirical correlations.

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