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The stability of Taylor bubbles in large-diameter tubes: direct numerical simulations[1] AMANJALOT DHANJAL, MAYA SARAVAN-BUTLER, SYDNEY SMITH, JUNFENG YANG, OMAR MATAR, Imperial College London — Slug flow corresponds to intermittent Taylor bubbles and liquid slugs, and is widely observed in the oil-and-gas industry. The fluctuating flow rate caused by Taylor bubbles is problematical; thus, the destabilisation of this regime would be beneficial. To gain better understanding of this regime in vertical tubes, three-dimensional CFD simulations of Taylor air bubble rise in initially stagnant water and progressively larger diameter tubes, are carried out. Tubes with diameters in the range of 0.032m-0.290m and a height of 2m are considered. The topology of the Taylor bubbles and their rise velocity are predicted and validated against experimental results. Our results suggest that the wake of leading bubbles plays a key role in the deformation and break-up of trailing bubbles. Motivated by these results, the effect of bubble separation distance, and aspect ratio, on bubble stability and the slug flow regime is investigated.

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