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The stability of Taylor bubbles in large-diameter tubes: Linear theory[1] HABIB ABUBAKAR, OMAR MATAR, Imperial College London — Taylor bubbles are a characteristic feature of the slug flow regime in gas-liquid pipe flows. With increasing pipe diameter, previous experimental observations have shown that at sufficiently large diameter (> 0.1 m), the slug flow regime, and hence Taylor bubbles, are not observed in gas-liquid flows in vertical pipes. Numerical simulations of a Taylor bubble rising in a quiescent liquid (see companion talk at this APS/DFD conference) have also shown that the wake of Taylor bubbles rising in a riser of such sizes is turbulent and has great impact on the stability of the subsequent, trailing bubbles. In view of these observations, a linear stability analysis is carried out to establish the stability conditions for a Taylor bubble rising in a turbulent flowing liquid. The stability of an axisymmetric Taylor bubble to a small-amplitude, three dimensional, perturbation is studied and the dimensionless flow parameters of the liquid investigated include the Froude number, the inverse viscosity number, and the Eotvos numbers.

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