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**Linear Stability of Taylor Bubbles in Downward Flowing Liquids**[1]

HABIB ABUBAKAR, OMAR MATAR, Imperial College London — A Taylor bubble rising against a downward flowing liquid in vertical pipes is known to lose its symmetric shape when the velocity of the liquid exceeds a critical value. The influence of the liquid flow conditions, characterised by the dimensionless Eötvös number, Eo, and inverse viscosity number, $N_f$, on the onset of transition from symmetric to asymmetric bubble shape, is examined using linear stability analysis. To gain insight into the underlying mechanism, an 'energy' budget analysis is carried out to isolate the most dominant energy term that drives the instability. The analysis shows that the driving mechanism is dependent on whether or not the effect of surface tension can be neglected. For negligible surface tension effects, the instability originates from within the bubble and the dominant source of energy that drives the instability is related to perturbations in the bubble pressure. In the case of strong surface tension, the mechanism is related to disturbances connected to the interfacial stress condition.

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Omar Matar
Imperial College London

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