Some improvements in flow regime prediction for stratified horizontal two-phase flow

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Résumé

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This work demonstrates an improved capability of linear stability analysis to develop two-phase flow regime maps for horizontal pipes. To this end, the methodology adopted follows that proposed by Barnea and Taitel (1993) and is based on the use of neutral stability curves obtained from viscous and inviscid linear stability analyses applied to a stratified, one-dimensional, isothermal two-phase flow. In this framework, particular attention is devoted to the determination of interfacial shear stresses and, consequently, to the selection of appropriate closure laws for the momentum balances of the liquid and gas phases.

The main innovation of this work lies in the use of the closure-law model proposed by Tzotzi and Andritsos (2013) to describe the interfacial shear stress between the two phases. This model account for the different types of waves that may exist at the interface of a stratified flow, in contrast to the model used by Barnea and Taitel (1993), which only discriminates their presence.

The obtained results are compared with the experimental data reported by Mantilla (2008), Henry (2016), and Bae (2019), demonstrating that the use of the model by Tzotzi and Andritsos (2013) leads to improved prediction of flow regimes under the investigated operating conditions.

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