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LINEAR STABILITY ANALYSIS OF MIXING LAYERS IN TWO-PHASE SHALLOW FLOWS

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Linear stability analysis of mixing layers in two-phase shallow flows is performed in the present paper. Hyperbolic tangent base flow velocity profile is used to model shallow mixing layer of two merging streams. The fluid contains uniformly distributed solid particles. The nonlinear system of shallow water equations under the rigid-lid assumption is linearized in the neighborhood of the base flow and is reduced to one linear partial differential equation. The use of the method of normal modes transforms the obtained partial differential equation to eigenvalue problem for a linear ordinary differential equation. The collocation method based on Chebyshev polynomials is used to solve the corresponding linearized eigenvalue problem. The stability calculations are performed for different values of the particle loading parameter and the velocity ratio. The results show that the particle loading parameter has a stabilizing effect on the flow while the increase in the velocity ratio destabilizes the flow.