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Unsteady Kelvin-Helmholtz instability of an inmiscible interface with a large contrast in viscosity HARUNORI YOSHIKAWA, JOSE-EDUARDO WESFREID, PMMH-UMR7636 (CNRS-ESPCI-P6-P7) — We studied a stability problem of two-layer oscillatory flows, especially with an interest in the case of a large contrast in viscosity at the interface. Preceding experimental studies showed that static deformations of the interface, often referred to as "frozen waves," happened beyond a threshold. Theoretically, we examined exhaustively the linear stability of the system for any viscosity contrast. What we found are: (i) destabilizing effect by the viscosity contrast and (ii) frequency dependence of the wave length selected by the linearly most instable mode. Instability is provoked by a smaller excitation in the case of large viscosity contrast within a certain band of frequency. The second point shows a deviation from the classical KHI. For high frequencies, the most instable mode has the capillary wave length, while for low frequencies, a longer one. Within an intermediate frequency range, the most instable mode can have a shorter wave length than the capillary one, depending on the viscosity contrast. We also realized a model experiment in a small-frequency range rarely investigated in the preceding studies. The two fluids were chosen so that the contrast in viscosity was very large (10^4 times difference in kinematics viscosity). Interface behavior was determined in detail. Results were in good agreement with our theoretical predictions.

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