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Effects of inclination and vorticity on interfacial flow dynamics in horizontal and inclined pipes ARETI KIARA, KELLI HENDRICKSON, YUMING LIU, Massachusetts Institute of Technology — The transport of oil and gas in long horizontal pipelines can be significantly affected by the development of violent roll waves and slugs, but the mechanics causing such transitions have not been well understood. To enable the improvement of the prediction of flow transition criteria in long pipelines we perform theoretical analysis and direct numerical simulations of multiphase pipe flows to quantify the roles of inclination and vorticity in the flow dynamics. We find that backflow or flooding may occur even in the absence of disturbances due to inclination effects and obtain criteria on the maximum pipe length for steady flows. We identify and compare the effects of inclination and vorticity on the stability of interfacial wave disturbances. We discuss the mechanisms of nonlinear energy transfer between stable and unstable wave disturbances and present results from direct numerical simulations for the predictions of spectrum evolutions for broad-banded interfacial disturbances in inclined pipes.

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