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Turbulent Two-Phase Flow of Kerosene and Water in a Vertical Pipe CARLOS PLANA, MARC AVILA, University of Bremen, Center of Applied Space Technology and Microgravity (ZARM), BAOFANG SONG, Tianjin University, Center for Applied Mathematics — Two-phase flows in pipes exhibit a variety of flow patterns, which depend on the numerous dimensionless parameters that govern the system. A common approach to understand this rich dynamics was pioneered by D.D. Joseph and co-authors, who investigated the linear instabilities of a particular configuration called core-annular flow, in which a fluid of high viscosity (core) is surrounded by a fluid of lower viscosity (annulus). We compute the linear stability of core-annular flow of kerosene and water in a vertical pipe and find that it is highly unstable. By performing direct numerical simulations initialized with a slightly perturbed core-annular flow, we show that the system transitions to turbulence and relaxes to a stratified configuration in which water and kerosene flow alongside. Our work highlights the need for applying nonlinear-dynamics approaches to understand the physical mechanisms underlying the patterns observed in two-phase pipe flows.

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