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Experiments and simulations of oil-water flows in horizontal pipes[1] ROBERTO IBARRA-HERNANDES, STUART WRIGHT, ZHIHUA XIE, CHRISTOS MARKIDES, OMAR MATAR, Imperial College London — The extraction of detailed information (e.g. velocity and turbulent data) in the flow of two immiscible liquid phases in horizontal pipes is of great importance for the fundamental understanding of the in situ hydrodynamics (and transport properties) of these flows, and the validation and improvement of advanced multiphase flow models. This detailed flow information can be obtained by the application of advanced laser-based diagnostic techniques, such as Planar Laser-Induced Fluorescence (PLIF) and Particle Image Velocimetry (PIV), however, the difference in the refractive index between the most relevant test fluids (oil, water) prevents the extraction of accurate information simultaneously in both phases, especially when the phases begin to develop interfacial instabilities, droplets and dispersions. In this work, a simultaneous, combined two-line technique is employed to obtain spatiotemporally resolved information in a 32 mm ID quartz pipe in terms of liquid phase distributions, velocity profiles and turbulence measurements. The experimental results are compared with numerical simulations carried out using the Fluidity code based on control-volume, finite-elements, and adaptive, unstructured meshing.

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