Abstract Submitted
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Characterization of Interfacial Waves and Pressure Drop in Horizontal Oil-Water Core-Annular Flows[1] AMITABH BHATTACHARYA, Indian Institute of Technology Bombay, Mumbai, 400076, India , SUMIT TRIPATHI, IITB-Monash Research Academy, Mumbai, 400076, India, RAMESH SINGH, Indian Institute of Technology Bombay, Mumbai, 400076, India , RICO TABOR, School of Chemistry, Monash University, Clayton 3800, Australia, K.S. VINAY, Indian Institute of Technology Bombay, Mumbai, 400076, India — Core-Annular Flows (CAF) consist of a highly viscous fluid (e.g. oils, emulsions) being pumped through pipelines while being lubricated by a fluid of a much lower viscosity (e.g. water). In a series of experiments, we study CAF with the core fluid as oil. We find a clear scaling for the energy spectra of the interfacial waves with respect to the shear Reynolds number Re_c of the fluid flow in the annulus. Specifically, we find that, at low values of Re_c, the low wavenumber modes of the interface appear to dominate, while, at high values of Re_c, the high wavenumber modes of the interface appear to dominate. Linear stability analysis of viscosity stratified flows appears to confirm this trend. The effective friction factor does not appear to change strongly with Re_c, suggesting that the interfacial waves do not significantly change the effective shear stress felt by the core fluid. This weak dependence of the friction factor on Re_c, along with a model for the holdup ratio, allows us to propose a very straightforward relationship between the pressure gradient and the flow rates of the core and annular fluids, which agrees with the experimental data.

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