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Characterization of interfacial waves in horizontal core-annular flow[1] SUMIT TRIPATHI, IITB-Monash Research Academy, Mumbai, India, AMITABH BHATTACHARYA, RAMESH SINGH, Department of Mechanical Engineering, IIT Bombay, India, RICO F. TABOR, School of Chemistry, Monash University, Australia — In this work, we characterize interfacial waves in horizontal core annular flow (CAF) of fuel-oil and water. Experimental studies on CAF were performed in an acrylic pipe of 15.5mm internal diameter, and the time evolution of the oil-water interface shape was recorded with a high speed camera for a range of different flow-rates of oil (Q_o) and water (Q_w). The power spectrum of the interface shape shows a range of notable features. First, there is negligible energy in wavenumbers larger than $2\pi/a$, where a is the thickness of the annulus. Second, for high Q_o/Q_w, there is no single dominant wavelength, as the flow in the confined annulus does not allow formation of a preferred mode. Third, for lower Q_o/Q_w, a dominant mode arises at a wavenumber of $2\pi/a$. We also observe that the power spectrum of the interface shape depends weakly on Q_w, and strongly on Q_o, perhaps because the net shear rate in the annulus appears to depend weakly on Q_w as well. We also attempt to build a general empirical model for CAF by relating the interfacial stress (calculated via the mean pressure gradient) to the flow rate in the annulus, the annular thickness and the core velocity.

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