

## MULTIPHASE FLOWS WITH TWO LIQUID PHASES

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### ABSTRACT

Liquid-liquid two-phase flows and liquid-liquid-gas flows occur widely in industrial applications. A particularly important case is in hydrocarbon recovery where such flows occur in subsea pipelines carrying produced fluids (oil, water and natural gas) from subsea wells to on-shore or platform-based processing facilities. The presence of a second liquid phase makes gas-liquid flows even more complex. At higher gas velocities, the liquid phases tend to become inter-dispersed. The dispersions formed can either be of oil drops dispersed in water or water drops dispersed in oil. The transition between one form of dispersion and the other is called *phase inversion* and is accompanied by anomalous behaviour signalled by a large increase in pressure gradient. A similar inversion phenomenon occurs in liquid-liquid flows at high superficial velocity. In this presentation, recent Imperial College work on this class of flows will be presented. This includes studies of overall parameters such as pressure gradient and phase holdups (the latter being measured using dual energy gamma densitometry) and investigations of local phenomena and parameters (e.g. drop size and interfacial structure) using advanced optical and other techniques. Both steady state and transient flow have been studied. Progress on meeting the formidable challenges of modelling such flows is also reviewed.