Numerical simulation of two- and three-phase flows in large horizontal pipes

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The aim of the European EMRP project ENG58 "Multiphase Flow Metrology in the Oil and Gas Sector" (MultiFlowMet) is to reduce the measurement uncertainty under field conditions. An experimental ring comparison on the one hand and computational fluid dynamics on the other hand are used to achieve this goal.
In this contribution, numerical simulations of two- and three-phase flows will be presented. According to the experimental set-up within the project, the simulations focus on the flow of water, kerosene, and nitrogen in 8 to 16 m long horizontal pipes of diameter $D=0.104$ m. Different gas volume fractions as well as different superficial gas and liquid velocities are considered leading to different flow patterns, namely stratified, stratified wavy, elongated bubble, and slug flow. The observed flow patterns are validated by comparison with previous experimental and numerical investigations [1,2,3]. Furthermore, the influence of fluctuations prescribed at the inlet, numerical discretization schemes, and the damping of the turbulent diffusion at the interface between the phases is studied.

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