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SIMULATION OF THE TWO PHASE FLOW IN A WELLBORE USING TWO-FLUID MODEL

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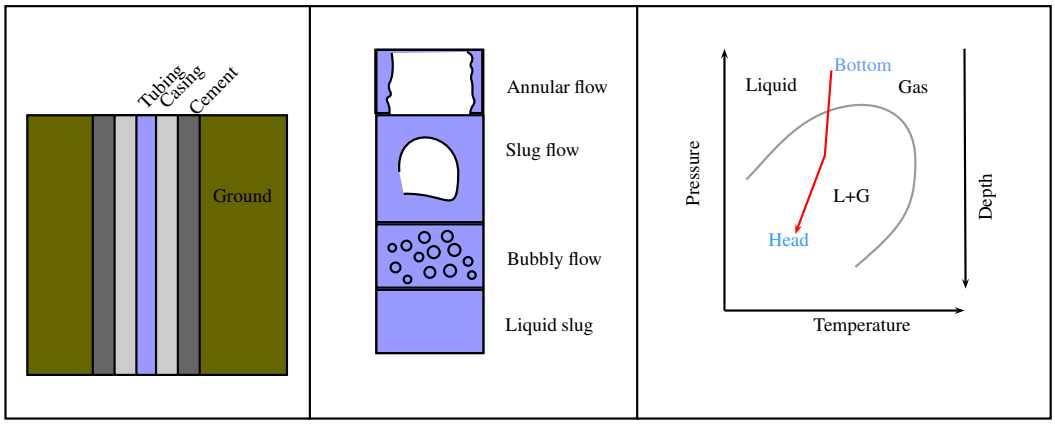
In a typical case, crude oil flows from reservoir up to a wellbore as liquid, however, when fluid reachs the surface, dissolved gas is liberated and a second phase appears, this is due to a change of pressure and temperature. The figure 1 shows a typical geometry of the well, the flow patterns that can be found in a vertical pipe and the change of pressure, temperature and phase with the depth.

Figure 1: Basic geometry in a wellbore, flow patterns presented in a vertical oil well, change in the flow pattern from bottom well until surface.



It can exist up to three phases in the fluid flow of a pipeline in a oil well: liquid (crude oil and water), gas (methane, ethane,...) and solids (sands)[1]. Ignoring sand existence (and its issues associated), the flow in the wellbore can be considered as a two-phase one. Notwithstanding two phase flow in the wellbore is common, it has mainly studied using mechanistic or simplified models [2][3], and the predictions of the models can show high

discrepancies. Furthermore, these models work only for steady state flows. Therefore, in this work one dimensional two fluid model is implemented to simulate two phase flow in the tubing of an oil well. The main objective of the simulation is to predict the pressure drop more accurately for steady and unsteady states. Moreover, a heat transfer analysis in the wall of the pipeline is carried out. In addition, thermo-physical properties of the fluids are calculated using the black oil model.

The two fluid model has been implemented in the oil industry [4] [5], however, they do not use the change of mass term due to liberation of gas from oil or the model is implemented for one flow pattern. The implemented model will be flow pattern dependent and will use the change of mass term explicitly, it will be focus on vertical upward flow.

This work is part of a larger research aimed to predict paraffin depositions in the wall of the pipeline. The information predicted by this work (velocities, pressures and temperatures in the tubing) will be used to calculate if well suffers of deposition in the wall of the pipe and quantity of precipitated material.

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