AMERICAN UNIVERSITY OF BEIRUT

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The Use of PETREL for the Stochastic Optimization of the Oil Production Process

A Research Proposal submitted to the
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Background

The oil production process goes through several stages. In the primary stage, the natural pressure of the reservoir displaces the oil up to the surface. Typically this stage reaches its limit once the pressure in the reservoir is too low that the production rate is not economical. Consequently, the secondary recovery stage relies on injecting fluids into the well to help maintain or increase its pressure. When water is used, the process is commonly known as water flooding. The injected water physically sweeps the displaced oil and the recovery stage reaches its limit once the injected fluid reaches the production wells. At that stage, more sophisticated techniques that alter the original properties of oil are used. Water flooding is the most commonly used method for secondary oil recovery. Potential problems associated with water flooding include inefficiency due to variable permeability or other conditions affecting fluid transport within the reservoir. These conditions could be pertaining to an impermeable obstruction that is incapable of transmitting fluids. Under such circumstances oil might migrate and get trapped below or within these impermeable units. Reservoir simulation is a powerful tool for reservoir characterization and management as it enhances the production forecasting process. The efficiency of a reservoir model, therefore, relies on its ability to characterize the geological and petro-physical features of the actual field. In this study, the Schlumberger state-of-the-art reservoir simulation package, Petrel will be used. Petrel provides a model-based environment for reservoir engineering workflows [17].

The objective of this study is to optimize the secondary oil production process by varying the injection paradigm; i.e. by specifying the optimal number of injection and production wells and their spatial distribution to maximize the water flooding efficiency.