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New Generation Reservoir Simulation and Innovative EOR Methods

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1. Introduction

EOR methods became popular in the 1970's and early 1980's, but following the decline of oil prices the mid eighties, were considered uneconomical and disappeared from the top priorities of the oil industry. In the context of the high oil prices which have been prevailing since the last 2-3 years, there is again a growing interest for enhanced oil recovery. In the meantime, the Oil Industry has started implementing the so called 'Next generation Reservoir Simulators', aiming at replacing the existing commercial reservoir simulator with new simulation tools better suited to cope with the challenges of future reservoir management. We investigate in this paper the particular technical challenges posed by modern EOR strategies in terms of reservoir simulation requirements. These challenges includes the following point :

1. Improved physical formulation of production mechanisms associated with EOR methods (HC and non HC gas injection, thermal methods, surfactants, polymers etc) and capacity to use lab and pilot data to validate the formulation using inverse methods.
2. Increased capacity to model and represent geological characteristics of reservoirs that critically control the efficiency of EOR methods (such as : vertical permeability, presence of faults and compartementalization, fractures, channels), which in turn poses new requirements for grid cells, grid size, modelling methods etc.
3. Computational challenges, which new parallel computing methods associated with advanced processing technology will resolve,
4. More importantly, need to define workflows in various modelling tolls of various vintages can be easily . capacity to customize workflows to each field requirements, and drastic reduction of efficiency and duration of study.

We will illustrate how these different challenges are dealt with in IFP's new generation simulation project FIRST, and the various modules which have been developed in cooperation with the industry (the simulator Puma[Flow], the fracture module Fraca[Flow], the Assisted History Match loop Condor[Flow] and the work environment OpenFlow).