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A Strategy to Oil Production Placement Zones Based on Maximum Closeness

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Abstract : Increasing the oil recovery factor of an oil reservoir has been a concern of the oil industry. Usually, the production placement zones are defined after some analysis of geological and petrophysical parameters, being the rock porosity, permeability and oil saturation of fundamental importance. In this context, the determination of hydraulic flow units (HFUs) renders an important step in the process of reservoir characterization since it may provide specific regions in the reservoir with similar petrophysical and fluid flow properties and, in particular, techniques supporting the placement of production zones that favour the tracing of directional wells. A HFU is defined as a representative volume of a total reservoir rock in which petrophysical and fluid flow properties are internally consistent and predictably distinct of other reservoir rocks. Technically, a HFU is characterized as a rock region that exhibit flow zone indicator (FZI) points lying on a straight line of the unit slope. The goal of this paper is to provide a trustful indication for oil production placement zones for the best-fit HFUs. The FZI cloud of points can be obtained from the reservoir quality index (RQI), a function of effective porosity and permeability. Considering log and core data the HFUs are identified and using the discrete rock type (DRT) classification, a set of connected cell clusters can be found and by means a graph centrality metric, the maximum closeness (MaxC) cell is obtained for each cluster. Considering the MaxC cells as production zones, an extensive analysis, based on several oil recovery factor and oil cumulative production simulations were done for the SPE Model 2 and the UNISIM-I-D synthetic fields, where the later was build up from public data available from the actual Namorado Field, Campos Basin, in Brazil. The results have shown that the MaxC is actually technically feasible and very reliable as high performance production placement zones.

Keywords : hydraulic flow unit, maximum closeness centrality, oil production simulation, production placement zone
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