Well Placement of Oil Wells Using Multi Well Productivity Index Method (MPI)

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Abstract

Reservoir Simulation as part of reservoir engineering is used to predict fluid flow through porous media. It has the ability to provide good estimation and is needed to help in making investment decision. Rather than relying on expensive experimental tools and measurements such as well tests, well logs, laboratory tests, and seismic tests, reservoir simulation models can help us to get an improved estimation of reserves and to develop the field. In this research, we have introduced one of the reservoir simulation methods called MultiWell Productivity Index (MPI) model which is not only reliable, fast, and simple but also requires a minimum data to predict the performance of the reservoir. The MPI approach is used to predict the performance of a homogenous reservoir under various conditions.

In this research, we used MPI model to calculate pressure distribution around each well by developing pressure distribution map in the reservoir field. By computing the influence of each well at each location in the reservoir, pressure field lines are created and pressure distribution map is developed. To find the productivity of multiple wells, the influence between the wells and its own influence on the reservoir is quantified in a square matrix form (hence called Multi-well Productivity Index method). Pressure change is created by the rate of flow of individual well and is calculated at each point in the reservoir by MPI method. By using pressure distribution maps, we define drainage area of producing wells. Once the drainage area has been defined, any area with a higher pressure gradient in the reservoir unaffected by current well's flow rate, will be suggested as a possible location with high oil residue saturation. Hence, the method could provide the location which is appropriate to allocate infill well to enhance oil recovery.

The result of this study was compared with one of the simulator methods called CMG (Computer Modeling Group) and was a good agreement observed between the two methods. We applied the approach to several cases and found excellent evaluation when compared with CMG simulator outcomes. ii

This report consists of three parts- In the first part, we developed the pressure distribution map to represent the pressure change in the reservoir using MPI model. In the second part, we analyzed the drainage area around each producer well in the reservoir by examining the pressure distribution map. In the third part, we selected the area which could be appropriate to introduce infill drilling well by observing higher pressure and more oil residue saturated area. Pressure distribution simulation by MPI method was compared with CMG pressure simulation and it was found that the difference was less than 1%.

In short, compared to other methods of specifying the location of infill drilling wells, MPI method is a fast and simple analytic tool, and requires lesser data for analysis. A further

advantage of this method is that, it gives reliable estimation in a short time which is suitable for various decision making processes..