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Taguchi and BEM Analyses on the Productivity Performance of an Oil Reservoir

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Abstract. The application of Taguchi Robust Design Technique (TRDT) coupled with the Boundary Element Method (BEM) in analyzing the productivity performance of an oil reservoir is presented in this paper. Several reservoir rock and reservoir fluid properties; i.e. permeability, thickness, porosity and viscosity, were chosen in this study. The BEM allows the overall simulation of reservoir performance to be made; whereas the used of TRDT allows us to rank the most influencing factor (property) that affects the productivity performance of the reservoir. Numerical values obtained from the BEM analysis will be used as input data for the TRDT statistical analysis. Results indicated that oil viscosity is the most important factor that affects the productivity performance of the oil reservoir followed by the thickness of the pay zone, the rock permeability and the rock porosity. Results of this study can be used by reservoir engineer in making the right choice of Enhance Oil Recovery techniques that is the most suitable for the reservoir.

Taguchi Method

In this study, Taguchi Robust Design Technique (TRDT) was used to rank factors that may effect the productivity of oil reservoir. The use of Taguchi orthogonal array helps to determine the minimum number of simulation runs needed to produce the most favourable output for a given set of factors. These factors are rock permeability, reservoir oil viscosity, thickness of net pay and reservoir rock porosity. The comparison between full factorial design and Taguchi design is shown in Table 1. The orthogonal array L_9 was used to study the influence of these four factors. Each factor was considered at three levels. The factors involved and their levels are shown in Table 2. If full factorial experimental design were used, it would require 81 (3^4) trials runs for all possible combinations of these factors to get the optimum result [1]. By using the Taguchi orthogonal array L_9 for experimental design, the number of trials runs was reduced to 9 simple and effective experiments.