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A DERIVATIVE-FREE TUNNELING METHOD TO CHARACTERIZE OIL RESERVOIRS

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We are solving the characterization of Naturally Fractured Reservoirs in porous media that present triple porosity and double permeability, using well test data. The characterization allows the prediction of the production of the well. These kind of reservoirs represent the most productive wells in Mexico, and thus the need to study them. The commercial software available up to now, do not consider the triple porosity effect.

The solution of this inverse problem requires the use of a robust Global Optimization Method, capable to deal with very flat and/or very sharp valleys of the objective function, in order to obtain optimal solutions with high precision, in order to fit the data.

In the case of partially penetrated wells, the computation of the gradient of the objective function implies the computation of as many infinite series as number of parameters to identify. Therefore it is necessary to use a derivative free global optimization method. In this case we have developed a Derivative-free Tunneling Method that incorporates the ideas of the method developed by M. Powell, called BOBYQUA to solve the problem.

We will present the characteristics of the flux model, its sensitivity to the various parameters to be identified, the sequential optimization we use taking into account these results, and will present the characterization results we obtain on a large representative set of synthetic problems that show the effectiveness and robustness of the Derivative-free Tunneling Method.

We will also present results on a set of REAL Mexican Naturally Fractured Reservoirs and compare these results with the ones obtained using the available software, to show the impact of the triple porosity and to show that this methodology identifies a larger number of parameters that describe the reservoir more accurately.