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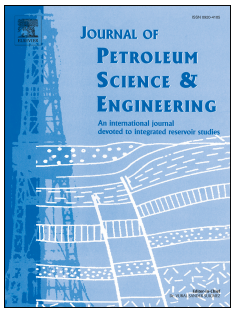

Scale up of pore-scale transport properties from micro to macro scale; network modelling approach

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Scale Up of Pore-Scale Transport Properties from Micro to Macro Scale; Network Modelling Approach

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Abstract Prediction of reservoir production using different technical scenarios and designs is essential for optimization of reservoir development plan. Due to the enormous scale of a reservoir, the simulators use simplified discretized equations to predict the production and other properties of the reservoir. Therefore, they cannot observe complicated physical phenomena that occur at the pore scale. Such phenomena have significant effect on the relative permeability of the fluids which is an important factor for predicting multiphase flow behaviour at reservoir scale. To remedy this problem, one can simulate the fluid flow in the pore scale and predict relative permeability curves for various rock types. To scale up the relative permeability curves from the pore-scale, it is necessary to scale up the porosity, permeability, and capillary pressure curves. This study is the first step towards this goal. The objective of this research is to calculate the single phase and immiscible two-phase flow properties including porosity, permeability, and capillary pressure of drainage and imbibition processes using random-network modelling technique and then scaling up the results to macro scale. This is done by generating four virtual porous media with various properties by simulating sedimentation process and dividing them into 8 sub-segments. Flow properties of all the sub-segments are computed using a network modelling technique. Flow properties are then scaled up to reconstruct the original macro scale media. Finally, the results are compared to ones obtained directly from the original samples. Results show relative errors ranging from 2% to 10% for homogenous and heterogenous media respectively. As the level of heterogeneric increases, deviation of the scaled-up properties from original values rises.

Keywords scale up, pore scale, single phase, multi-phase, network model

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