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Finite Element Model to Evaluate Gas Conning Phenomenon in Naturally Fractured Oil Reservoirs

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Abstract : Gas conning phenomenon considered one of the prevalent matter in oil field applications as it significantly affects the amount of produced oil, increase cost of production operation and it has a direct effect on oil reservoirs recovery efficiency as well. Therefore, evaluation of such phenomenon and study the reservoir mechanisms that may strongly affect invading gas to the producing formation is crucial. Gas conning is a result of an imbalance between two major forces controlling the oil production: gravitational and viscous forces especially in naturally fractured reservoirs where the capillary pressure forces are negligible. Once the gas invading the producing formation near the wellbore due to large producing oil rate, the oil gas contact will change and such reservoirs are prone to gas conning. Moreover, the oil volume expected to be produced requires the use of long horizontal perforated well. This work presents a numerical simulation study to predict and propose solutions to gas coning in naturally fractured oil reservoirs. The simulation work is based on discrete fractures and permeability tensors approaches. The governing equations are discretized using finite element approach and Galerkin's least square technique (GLS) is employed to stabilize the equation solutions. The developed simulator is validated against Eclipse-100 using horizontal fractures. The matrix and fracture properties are modelled. Critical rate, breakthrough time and GOR are determined to be used in investigation of the effect of matrix and fracture properties on gas coning. Results show that fracture distribution in terms of diverse dip and azimuth has a great effect on conning occurring. In addition, fracture porosity, anisotropy ratio, and fracture aperture.

Keywords : gas conning, finite element, fractured reservoirs, multiphase
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