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Investigating the Behavior of Permeable and Impermeable Reservoirs in Southern of Iraq

Amani J. Majeed[1,a], Ahmed Al-Mukhtar[2,b*], Falah A. Abood[3,c], Ahmed K. Alshara[4,d]

[1]Petroleum Engineering Department, University of Basrah,

[2]Al-Hussain University College, Iraq

[2]Institute of Structural Mechanics, Bauhaus-Universität Weimar, Germany

[3]Mechanical Engineering Department, University of Basrah, Iraq

[4]Mechanical Engineering Department, University of Misan, Iraq

[a]Iraq amani.majeed@uobasrah.edu.iq, [b]almukhtar@hotmail.de, [c]flahabood@gmail.com
[d]dr.ahmed_alshara@uomisan.edu.iq

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Abstract: The effect of fracturing on the permeability and fluid flow of various Iraqi oil reservoirs has been studied. Rumaila, Majnoon, and Zubair fields were investigated in this study. These reservoirs have different flow properties. The Element based Finite Volume Method (EbFVM) corresponding to the Dual Porosity Dual Permeability Model (DPDP) was used. The fractured reservoir in the Iraqi fields was studied for its single-phase fluid flow behavior. To represent the pressure distributions, ANSYS-CFX program was used. By making an internal hole, comparisons between the fractured and non-fractured cores have been presented. In this paper, the pressure for permeable cores of Rumaila field has been determined, since it requires a lower pressure. Therefore, experimental and numerical simulation can be verified. Hence, the proposed model for permeable cores will be used for impermeable cores. The required pressure for the impermeable cores of Majnoon and Zubair fields has been numerically determined due to the difficulties of the measuring of such high pressure using an experimental test. Therefore, the motivation of this study is to predict the pressure that the fluid-permeability device has to be considered to measure the permeability in impermeable environments. The results show that the expected pressure to make a flow into the core belonging to the Majnoon field reaches 1.724×10^7 Pa (2500 psi), while the expected pressure for the fluid to flow into the core belonging to the Zubair field reaches 1.379×10^8 Pa (20000 psi). Experimentally, the latter value is inapplicable.

Introduction

Fracture pressure is required to create the cracks and to increase the fluid flow, i.e., increasing the productivity. Therefore, a determination of the permeability and fracture pressure has a big draw.

The presence of fractures will increase the permeability and increase the production rate in reservoirs. Therefore, the using of dual permeability is more significant in the case of fractured reservoirs.

Fluid within a reservoir is greatly affected by fractures. The fractured reservoir has high porosity and permeability. In such cases, the single porosity model is not sufficient [1]. Models such as DPDP have been widely used for simulating fluids flow in fractured reservoirs, as they provide an accurate representation of the flow [1–4]. The DPDP model, however, has some difficulty describing the behavior, see Refs. [5, 6]. In 1960, the first DPDP model was developed [7]. A basic understanding of the theory of liquid flow in fractured rocks was presented [7]. Warren and Root modified the double-porosity model in 1963 to represent characteristics of flow behavior in a reservoir with natural fissures [8].

Thereafter, it was concluded that the Warren and Root model can be applied when the distribution of fissures is uniform and the difference between the permeability of the fissure and the matrix is large [9]. Since that time, many studies have described dual-porosity models of fluid flow through a