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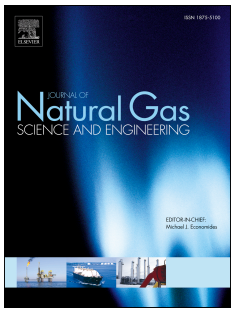

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M.J. Ahammad, M.A. Rahman, L. Zheng, J. Alam, S.D. Butt

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Numerical Investigation of Two-Phase Fluid Flow in a Perforation Tunnel

M. J. Ahammad[1], M. A. Rahman[2], L. Zheng[1], J. Alam[1], S. D. Butt[1]
[1]Memorial University of Newfoundland, Canada
[2]Texas A&M University at Qatar

Abstract: The reservoir productivity index depends on the performance of fluid flow through the perforated tunnels. Experimentally, it was observed that higher fluid flow rate occurs in perforation by drilling technique compare to the traditional shooting technique. This behavior is favorable for the increased hydrocarbon production from a formation. The better understanding of formation damage mechanisms for various reservoir conditions can be optimized for the economic benefits and managerial decision. The perforation by drilling (PD) technique is proposed as an alternative perforation technique since this technique induces less formation damage. Experimental and numerical investigations are ongoing research in this regards. The primary results of the two-phase fluid flow through porous media to a perforation tunnel are modelled using ANSYS CFX-15 platform. The numerical data were validated with the experimental data. The effects of different petro-physical properties were analyzed in the simulation such as permeability, porosity, fluid viscosity, flow rates, and injection pressure.

Keywords: Computational fluid dynamics (CFD), perforation, porous media, two-phase flow.

1. Introduction

Recent years, the proportion of natural gas is increasing significantly for the adjustment of energy sources structure and the fast development of urban fuel gas industry (Wu et al., 2016). Nevertheless, natural gas is often extracted with water in most gas fields. This indicates that multiphase flow, especially gas-water two-phase flow, is more common in a gas reservoir. In addition to oil and gas fields, the theory of multiphase flow in porous media can also provide more information to understand the flow phenomena in aquifer and CO_2 storage (Horgue et al., 2014). Thus, the research in multiphase flow through porous media is of profound importance in many active research area such as petroleum engineering applications.

The perforation is a communication media that connects the reservoir formation with the wellbore to produce oil or gas. The perforation is created to increase the production rate, though there are some disadvantages of the perforation which leads to damage the virgin reservoir (Renpu, 2011). There are different types of technique for perforation (Behrmann, et al., 2002). The performance of perforation depends not only various perforation characteristics such as length, radius, density, phasing angle, but also perforation techniques (Economides et al., 1994). A proper perforation technique can increase the production by 10–20% (Bell and Clark, 2009). The perforation technique for the gas reservoir is different than the oil reservoirs (Civan, F., 2015). The influence of the well completion and perforation performance, and ultimately reservoir life fully depends on the productivity index (Dake, L. P. ,2001). . All these factors are subject to

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