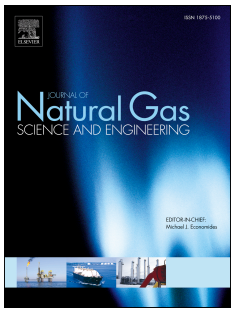
Accepted Manuscript



Production performance analysis of multiple fractured horizontal wells with finite-conductivity fractures in shale gas reservoirs

Wenchao Teng, Xin Qiao, Lin Teng, Ruizhong Jiang, Jixiang He

PII: S1875-5100(16)30768-5

DOI: 10.1016/j.jngse.2016.10.030

Reference: JNGSE 1876

To appear in: *Journal of Natural Gas Science and Engineering*

Received Date: 12 June 2016

Revised Date: 27 September 2016

Accepted Date: 20 October 2016

Please cite this article as: Teng, W., Qiao, X., Teng, L., Jiang, R., He, J., Production performance analysis of multiple fractured horizontal wells with finite-conductivity fractures in shale gas reservoirs, *Journal of Natural Gas Science & Engineering* (2016), doi: 10.1016/j.jngse.2016.10.030.

Production performance analysis of multiple fractured horizontal wells with finite-conductivity fractures in shale gas reservoirs

Wenchao Teng[1,*], Xin Qiao[1], Lin Teng[1], Ruizhong Jiang[1], Jixiang He[1]

1. *School of Petroleum Engineering, China University of Petroleum (East China), Qingdao 266580, CHINA*

[*] *Corresponding author. E-mail address: 1531568245@qq.com*

Abstract

Shale gas flow is controlled by multiple mechanisms and multi-stage hydraulic fracturing often creates complex fracture geometry. It is very challenging to incorporate various migration mechanisms of shale gas and evaluate production performance of the multiple fractured horizontal well (MFHW) in shale gas reservoirs. This paper presented a new semi-analytical model to study the pressure behavior and production performance of MFHWs with finite conductivity fractures in shale gas reservoirs. Multiple migration mechanisms were considered, which contained diffusion in kerogen bulk, desorption from the surface of organic matters and clay minerals, slippage flow in matrix pores, transient-state inter-porosity flow and Darcy flow in natural fractures. Finite-conductivity hydraulic fractures, stress sensitivity effect and inclination angles were also taken into account. Line source function, Laplace transformation, perturbation technique, numerical discrete method, Gauss elimination method and Stehfest inversion algorithm were employed to calculate the pressure responses. A field case from Barnett Shale was used to illustrate the validity of this model. Type curves were plotted and flow regimes were identified. A synthetic case was used to study the effects of hydraulic fracture conductivity, inclination angle, permeability modulus, kerogen content, clay minerals content, solubility coefficient, diffusion coefficient, Langmuir pressure and Langmuir volume on well production performance. By performing sensitivity analysis of key factors, we came to some conclusions that hydraulic fracture conductivity has an optimal value for shale gas development (a fracturing treatment); a small inclination angle and a large permeability modulus has a negative effect on well performance while a large Langmuir pressure and Langmuir volume has a positive effect; both clay minerals and organic matters contribute to shale gas production; dissolved gas stored in kerogen bulk should be considered and a larger diffusion coefficient is beneficial for dissolved gas to release. With its rapid computational speed, this semi-analytical approach will serve as an efficient tool to evaluate well productivity and provide critical insights into development optimization of shale gas reservoirs.

Keywords: Shale gas; Multiple fractured horizontal wells; Finite conductivity; Transport mechanisms; Production