

REN Long, SU Yuliang, XU Chen and MENG Fankun, 2015. Advances in the Method of Production Performance Prediction of SRV-fractured Horizontal Wells. *Acta Geologica Sinica* (English Edition), 89(supp.): 319-320.

Advances in the Method of Production Performance Prediction of SRV-fractured Horizontal Wells

REN Long*, SU Yuliang, XU Chen and MENG Fankun

The College of Petroleum Engineering, China University of Petroleum(Huadong), Qingdao Shandong 266580, China

As the representative techniques of stimulating production performance, horizontal well and stimulated reservoir volume(SRV) fracturing are applied successfully in unconventional oil/gas reservoirs, such as Bakken and Eagle Ford, and will become the core stimulating techniques to exploit unconventional reservoirs in the future. In the process of horizontal well SRV fracturing, complex fracture network are produced which improves the reservoir flowing area, fracture conductivity and SRV, therefore, the single well oil production rate and reservoir ultimate oil recovery could be raised^[4-5]. Since the horizontal well SRV fracturing is the key technique to develop tight oil & gas reservoirs, shale oil & gas reservoirs and the other unconventional reservoirs economically and efficiently, how to build the accurate productivity prediction model is the hot issue and highlight for many scholars. Many researches pay much attention to how to build the accurate productivity prediction model. As productivity of conventional energy resources lowers and the proportion of reserves in unconventional oil/gas increases, the theoretical method about production performance prediction needs to be improved to innovate SRV fracturing technology of horizontal wells. Based on the structural description of fracture network around horizontal wells, we summarize and evaluate analytical/semi-analytical and numerical production performance prediction model of SRV-fractured horizontal wells presented by scholars at home and abroad, and present the issues of above models. On the basis of above study, this paper analyzes problems and difficulties of existing production performance prediction models. Five key technologies involved in building accurate production performance prediction model are presented.

Horizontal well SRV fracturing has large effect on stimulating effective reservoir volume and enhancing oil recovery in unconventional reservoirs. It is significant to reasonably and efficiently develop the unconventional

resources by summarizing the theoretical advancement of horizontal well SRV fracturing productivity prediction.

(1) The horizontal well SRV productivity prediction methods mainly include analytical or semi-analytical and numerical solution, which on condition that the suited assumption of physical model and equivalent grid discretization simulation, respectively. The presented prediction model can be divided into three kinds, bi-wing & symmetric fracture network, orthogonal fracture network (wiremesh) and unconventional fracture model(UFM), on the basis of difference of fracture patterns(Table 1).

(2) Each model and method have certain assumption conditions in the process of birth and development, which lead to these methods or models exist much limitation and feasibility by themselves. Although analytical models are always convenient and quick, these models are too ideal to describe the actual condition of fracture network; semi-analytical models have higher calculation accuracy, but the single-phase production performance prediction is only applicable to single well; the unconventional fracture model solved by numerical method could deal with more complex fracture network forms and calculate the multiphase production capacity of well pattern, however, it needs take more time and expertise to build and solve the model, and the upfront input is complex.

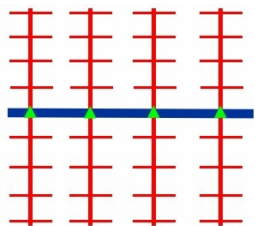
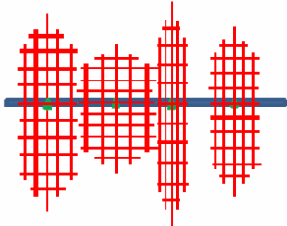
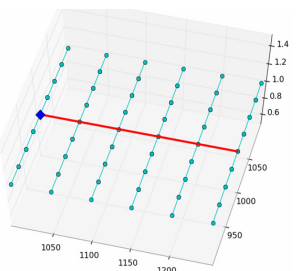
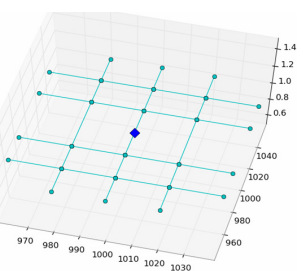
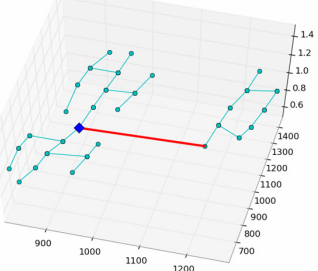
(3) How to accurately demonstrate the real SRV fracturing complex fracture forms, to simulate the multiphase flow in fracture network and to improve the algorithm calculation efficiency are the key point to establish the productivity prediction model with high precision. Building accurate production performance prediction model depends on several important techniques, which includes complex fracture network description technology, multiphase flow simulation technology, coupling seepage theory of multi-scale and multi-field, complex model numerical solution technology and the matching technology between well type, well pattern and fracture network system.

* Corresponding author. E-mail: dragon_rmb@163.com

References

- Wu Qi, Xu Yun, Wang Xiaoquan, Wang Tengfei and Zhang Shouliang, 2012. Volume fracturing technology of unconventional reservoirs: Connotation, optimization design and implementation. *Petroleum Exploration and Development*, 39(3): 352-358.
- Wu Qi, Xu Yun, Liu Yuzhang, Ding Yunhong, Wang Xiaoquan and Wang Tengfei, 2011. The current situation of stimulated reservoir volume for shale in U.S. and its inspiration to China. *Oil Drilling&Production Technology*, 33(2): 1-7 (in Chinese).
- Jia Chengzao, Zheng Min and Zhang Yongfeng. Unconventional hydrocarbon resources in China and the prospect of exploration and development. *Petroleum Exploration and Development*, 2012, 39(2): 129-136.
- Wu Qi, Xu Yun, Wang Tengfei, and Wang Xiaoquan, 2011. The revolution of reservoir stimulation: An introduction of volume fracturing. *Natural Gas Industry*, 31(4): 7-12 (in Chinese).
- Weng Dingwei, Lei Qun, Xu Yun, Li Yang, Li Deqi and Wang Weixu, 2011. Network fracturing techniques and its application in the field. *Acta Petrolei Sinica*, 32(2): 281-284 (in Chinese).
- Stalgorova, E., Mattar, L., 2013. Analytical model for unconventional multifractured composite systems. *SPE Reservoir Evaluation & Engineering*, 3(16): 246-256.
- Su Yuliang, Wang Wendong, Sheng Guanglong, 2014. Compound flow model of volume fractured horizontal well. *Acta Petrolei Sinica*, 35(3): 504-510 (in Chinese).
- Cipolla, C.L., Lolon, E.P., Erdle, J.C. and Rubin, B., 2010. Reservoir modeling in shale-gas reservoirs. *SPE Reservoir Evaluation & Engineering*, 13(4): 638-653.
- Mayerhofer, M.J., Lolon, E.P., Youngblood, J.E. and Heinze, J.R., 2006. Integration of microseismic fracture mapping results With numerical fracture network production modeling in the Barnett shale. *SPE Annual Technical Conference and Exhibition: Society of Petroleum Engineers*.
- Su, Y.L., Ren, L., Meng, F.K., Xu, C. and Wang, W.D., 2015. Theoretical Analysis of the Mechanism of Fracture Network Propagation with Stimulated Reservoir Volume (SRV) Fracturing in Tight Oil Reservoirs. *PLoS ONE* 10(5): e0125319.
- Thomas D, Alfred L, William D, et al, 2013. Evaluating the effect of natural fractures on production from hydraulically fractured wells using discrete fracture network models. *Unconventional Resources Technology Conference: Society of Petroleum Engineers*.

Table 1 Classification table of calculation method for productivity prediction of SRV-fractured horizontal wells

Classification	Conventional fracturing (Bi-wing & Symmetric fracture)	Orthogonal fracture network (Wiremesh)	Unconventional fracture model (UFM)
Analytical model			
Semi-analytical model			
Numerical model	