Petroleum Research

Petroleum Research, 2019(December-January), Vol. 29, No. 108, 10-12

DOI: 10.22078/pr.2019.3654.2668

Accurate Estimation of The Well Test Parameters by Using a Hybrid Algorithm and Comparing It with Conventional Industrial Software

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DOI: 10.22078/pr.2019.3654.2668

Received: March/02/2019 Accepted: May/11/2019

INTRODUCTION

Well testing is one of the conventional methods for detecting well and reservoir parameters in petroleum engineering. In addition, this method is based on the measurement of pressure versus time in different production conditions and plotting them into pressure-time diagrams and determining permeability, skin factor, and wellbore storage coefficient [1,2]. Using the regression of the genetic algorithm, which has been introduced by Holland in 1975, the most likely reservoir models have been selected from several reservoir models, according to a set of pressure data by Guyaguler et al [3,4]. In the field of artificial intelligence in petroleum engineering, several tasks, such as predicting the rate of penetration with genetic programming and support vector machine, predicting porosity and permeability by fuzzy logic and SVM have been done [5,6].

METHODOLOGY

This study focusses on two homogeneous reservoir models, one infinite and another finite acting with no flow. To have the right basis for the analysis of relationships, high-quality pressure data are needed. It is difficult to obtain high-quality data in the well test operation. So by using reservoir simulator software, simulated pressure data have been created. In addition, some properties of two real models are shown in Table 1.

Table 1: some properties of study models.

Property/parameter	Model No.1	Model No.2
Model boundary	Infinite acting	Finite acting
Wellbore radius (ft)	0.35	0.45
Oil formation volume factor (bbl/STB)	1.4	1.5
Porosity (%)	14	18
Initial pressure (psi)	5000	5000

Because the pressure data have a lot of noises, the Daubechies wavelet transfer function has been used to create a better space for the analysis of computation. After removing noises, the genetic algorithm has been implemented, and its outputs have been applied in the Levenberg Marquardt algorithm.

RESULTS AND DISCUSSION

The results of applying this hybrid algorithm are compared to typical industrial software in Table 2. As we can see, the hybrid algorithm has been able to calculate well test parameters with excellent accuracy in comparison with the industrial software.

CONCLUSIONS

By using the hybrid algorithm, accurate well test parameters have been obtained. The hybrid algorithm has the highest accuracy in calculating wellbore storage coefficient, permeability and skin factor respectively in comparison with conventional industrial software.

Table 2: Results of hybrid algorithm and software.

Hybrid algorithm			Software results	
Parameter	Model No.1	Model No.2	Model No.1	Model No.2
Permeability (mD)	45.231	37.9514	45	36.9
Skin factor [dimensionless]	3.3652	2.5274	3.2	2.57
Wellbore storage coefficient (bbl/psi)	0.006687	0.005128	0.0066	0.00509
External radius (ft)	------	607.4139	---------	617

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