Well-Testing Model Identification using Time-Series Shapelets

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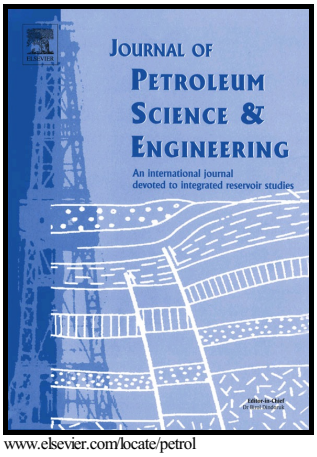

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Well-Testing Model Identification using Time-Series Shapelets

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ABSTRACT

The well-testing model identification is a challenging task due to non-uniqueness of the pressure responses generated by different reservoir models. An automated framework is very useful to aid in diagnosing the well-testing interpretation models. Since the well-testing diagnostic plots are arranged nearly ordered in time, the well-testing model recognition could be considered as a time-series classification problem where different types of underlying reservoir models constitute different classes. A novel approach is proposed for the well-testing model identification from the pressure transient test data using the concept of shapelets in this article. Shapelets defined as time series subsequences which are in some sense maximally representatives of a class have been recently developed and used in time series classification and clustering problems.

Five different well-testing models (or classes) are investigated in this article. Shapelets are initially extracted for each pair of classes using the Fast-Shapelet algorithm and the minimum distances from the time series objects to the extracted shapelets are calculated to form a new feature space. Classification is applied on the new feature space using four different binary classifiers including random forest (RF), support vector machine (SVM), logistic regression (LR) and probabilistic neural network (PNN). The results verify that the RF technique yields the highest F-score value in predicting the true class labels among all the binary classifiers. To further improve the classification performance, an ensemble learner is finally created using the individual classifiers. The proposed approach is validated by testing against several real field test data. The results indicate that the shapelet-based approach is promising for the well-testing diagnosis applications.