Oil-based early warning theory analysis under Bayesian framework

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Abstract

With the gradual development of oil and gas field water injection development, there are increasing contradictions between reservoir and development. Stable yield become further difficulties. Sporadic blocks in the plane of residual oil distribution, upper section with unbalanced. The injection-production well spacing is imperfect. And the high degree of water problem is very obvious. It seriously restricted the reservoir development effect, and influenced the ultimate recovery of the oilfield. For oilfield measure a number of indicators is considered such as watercut rising rate, formation pressure condition, reservoir production extent, etc. This paper using the Bayesian method to comprehensive analysis the indicators pointed out some of major factor affecting extraction rate. According to some related date of oilfield development. Moreover using the Bayesian method is analytical and established early warning model of oilfield development. Thus it achieved the propulsion of the early warning system for oilfield development. The study can carry on the forecast to the oilfield development problem before, minimized the loss of oilfield development, which realized the purpose of improving oil recovery.

Keywords

Bayesian,Early warning ,Recovery ,Oilfield development.

1. Introduction

Exact warning oilfield oil production is to achieve a reasonable scientific development of oil fields, an important way to ensure stable oil production.Before the impact of the oil to reduce the economic benefits,oil warning giving the alarm, prompting the relevant personnel in advance to make a deal.

Currently most of our oil fields have moved into the middle and late stages of development, all kinds of issues become increasingly prominent.How to control water-stable oil, stabilize production from these fields is a serious problem faced the oilfield. Early warning is even more important. Before problems arise optimize control of its implementation of measures to control the complex process of oilfield development in the best running condition.

Currently warning of oil still in the early stages, there are early warning method oilfield oil production yield monitoring and early warning [1], oilfield water injection dynamic forecasting and early warning based on neural networks [2], the most advanced method of forecasting and early warning indicators for monitoring oil field [3], which use the most time-series forecasting theory [4], functional simulation model prediction method [5], the information type prediction method [6].These methods from a different angle to achieve the forecast oilfield development indicators, have some applicability and effectiveness.

This paper introduced Bayesian oilfield warning analyzes data based on real-time dynamic monitoring,It is the method mentioned above except that the use of the reverse way of thinking to consider the issue. Analysis of factors affecting the main reason oil recovery decline in default under. The establishment of appropriate early warning mechanism based on the results of the analysis, so in theory ensure the early warning targeted, it can play a better warning effect. Thereby increasing the economic efficiency of enterprises.

2. Reliability analysis of Bayesian formula

Meaning Bayesian formula lies in its philosophical sense, for there occurred an event A N subevent in the probability of the event A does not occur before people will N sub-events have a recognition, but after the event A occurs in people N sub-probability events will have a new understanding. If the total probability formula is seen by the "cause" push "results", then Bayesian formula contrary, its role is to "Result" push "reason", which in theory Bayesian formula in the fields of early warning reverse thinking application provides a theoretical basis.

$$p(y|\theta)=\frac{f(y|\theta)p(\theta)}{m(y)} \tag{1}$$

$$m(y)=\int f(y|\theta)p(\theta)d\theta \tag{2}$$

$m(y)$------Data edge density function

$p(\theta)$-------Priori probability

$f(y|\theta)$------Sampling density function data

3. Bayes′ formula applied in early warning analysis theory

Based on the actual situation of oil production, gathering survey data to identify factors that affect oil recovery of n, the initial consideration of these factors influence the oil recovery is relatively independent. In the case of relatively independent study will consider carefully the degree of association between various factors will play a catalytic role. Affect oil recovery factor of n, respectively

$A_1, A_2, A_3, \ldots, A_n$

$$p(B)=\sum_{i=1}^{n}p(A_i)p(B|A_i) \tag{3}$$

$$A_i \cap A_j=\varnothing(i\neq j) \tag{4}$$

$$p(B|A_i)=\frac{p(A_iB)}{p(B)}=\frac{p(A_i)p(B|A_i)}{\sum_{i=1}^{n}p(A_i)p(B|A_i)} \tag{5}$$

$$p(B)>0 \tag{6}$$

Late oilfield warning generally in oil field development, in the past a lot of data will be collected effectively influencing factors, each of the factors affecting the probability of oil recovery can be determined a priori probability it. Re-use of Bayesian theoretical calculations yield decline at the premise of the factors affecting the probability of recovery. Further recovery can fully understand the impact of factors, the maximum to avoid the unnecessary factor, thus providing a more accurate method to predict the future.

4. Conclusion

Oil warning is a nonlinear, time-varying complex long-term system. Based on the Bayesian framework for a new oilfield warning theory, on the one hand in the theoretical description of the Bayesian analysis of this reverse thinking warning is reasonable, on the other hand it can also provide early warning of a new way of thinking methods. On the basis of this theory can be analyzed on the next field data, model building oilfield warning made substantial step to provide a better way for the oil warning, increase the economic efficiency of enterprises in the Bayesian framework.

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