

Review on the modeling of oil and gas reservoir

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Abstract:- Reservoir geological modeling technology is a new technology developed in recent years. It is an important part of the description of the reservoir. It can realize the fine description and modeling of oil and gas reservoir, and quantitatively characterize and characterize the heterogeneity of reservoir, to study the uncertainty and investment risk in oil gas exploration and development. Reservoir modeling technology has a strong advantage in parameter estimation, reservoir heterogeneity, reservoir characteristics, and comprehensive utilization of various data. The technologies and methods of reservoir modeling can be divided into two categories: deterministic modeling and stochastic modeling, and the stochastic modeling technology is the developing direction of reservoir modeling technology. Points out the limitations of deterministic modeling and the advantages of stochastic modeling.

Key words: *Reservoir modeling; Deterministic modeling; Stochastic modeling.*

I. INTRODUCTION

Reservoir modeling is an important method for reservoir description, with the development of computer, the modeling of oil and gas reservoir has been developed rapidly, at present, the modeling of oil and gas reservoir is developing rapidly, and the reservoir modeling technology has become one of the core technologies of reservoir description. In recent years, some foreign oil companies, universities and institutions of scientific research institutions are dedicated to the research, the theoretical study of the same time, a lot of geological simulation software also appear. Reservoir modeling technique in the study of reservoir applied too late, but after a large number of committed to our storage layer of the staff for their tireless efforts, has in some key technical methods made great progress^[1-5].

In order to find out the distribution law of the remaining oil in the old oil field in high water cut period and to further improve the working level of rolling exploration and development, need to be more refined reservoir description, the establishment of a more sophisticated three-dimensional geological model. Reservoir geological modeling is the quantitative reservoir geological formations, structure and parameters of a technical means, mathematics and reservoir geology closely, and oil and gas reservoir, the product layer three-dimensional quantitative geological information obtained through the operation of the computer.

II. RESERVOIR GEOLOGICAL MODELING METHOD

At present, there are two methods of reservoir geological modeling, deterministic modeling and stochastic modeling. The stochastic modeling is the focus of domestic and foreign research in recent years.

A Deterministic modeling

Deterministic modeling is the prediction of the uncertainty of the well known area, from the point of control point (such as the well point) of the known deterministic data, and the only and real reservoir parameters are determined by the points (inter well). The main means include the use of seismic data (including 3D seismic and inter well seismic), the use of horizontal well data, outcrop analogy data, dense well network information, besides traditional interwell parameter interpolation methods such as anti square distance, Kriging method and some methods of mathematical geology belong to this kind of modeling method. At present, there are three kinds of methods for deterministic modeling.

a Reservoir sedimentology method

The method of reservoir sedimentology is mainly in the high resolution stratigraphic correlation and sedimentary model based on, through the interwell sandbody correlation to establish reservoir structure model. The main methods include the outcrop analysis and modeling, the high resolution stratigraphic correlation, the sand body contrast and the horizontal well modeling. Based on the modeling of reservoir sedimentology method is well data configuration, sediment source, sedimentary model, quantitative geological knowledge base.

b Reservoir seismic method

Reservoir seismology method (i.e. seismic data to determine transformation) is the main application of seismic data to study the storage layer geometry, lithology and parameters of distribution, namely from the well known point of, application of seismic lateral prediction technique were inter well parameters prediction, and the establishment of the three dimensional geological model of reservoir. This method mainly includes three dimensional seismic and well - seismic method. The 3D seismic data has the advantages of wide coverage and large horizontal collection, application of 3D seismic data, combined well data and VSP (vertical seismic profile), reservoir geological model can be set up in reservoir evaluation stage. And crosswell seismic technique using the downhole source and adjacent wells multi-channel absorption, so compared with surface seismic, such as 3D seismic has high signal-to-noise ratio, increasing the resolution of seismic data, the seismic wave early to accurately reconstruct the velocity field. The accuracy of the parameters of the reservoir is greatly improved.

c Kriging method

Kriging method is by variogram by data interpolation and reservoir parameter model is established. The basic idea is be estimated based on some known information around the point of using variable difference function specific properties of estimates of unknown point estimate of make the best (i.e. the estimate variance minimum), partial (i.e., estimating values and observation values mean the same). Kriging method for local estimation method, to estimate the value of global spatial correlation is not considered. It guarantees that the data for the estimation of local optimum, but can not guarantee the overall optimal data, because Kriging variance is smaller than the variance of the original data.

B Stochastic modeling

Due to the uncertainty and randomness of the deterministic modeling and the extreme complexity of the reservoir, the stochastic modeling technique is developed and applied widely. Stochastic modeling is based on the known information, with the random function as the theory, the application of the random simulation method to generate optional, and so the probability of reservoir model. Stochastic modeling in the understanding of the complexity of the underground sand, improve the characterization of heterogeneity, reservoir evaluation of uncertainty, Monte Carlo risk analysis and synthesis of complex information has obvious advantages.

III. LIMITATIONS OF DETERMINISTIC MODELING

The object of reservoir modeling is all kinds of geological features, such as the distribution of sedimentary facies and the distribution of the corresponding characteristic parameters. Actually the reservoir itself is determined, however, under incomplete information and complicated reservoir structure space allocation and reservoir parameter space changes the situation, people are difficult to grasp at any scale of reservoir determined and real feature or quality, that is to say, in the deterministic model exist uncertainties.

IV. ADVANTAGES OF STOCHASTIC MODELING OF RESERVOIR

Storage layer stochastic modeling of the advantage of reservoir stochastic modeling can be comprehensive utilization of effective (e.g. seismic, logging and outcrop and core data, information more accurately reflect the actual conditions of the reservoir, subdividing sedimentary microfacies; Reservoir stochastic modeling technology will be integrated into the reservoir description, which provides a more scientific basis for its interpretation; Using reservoir stochastic modeling technology can be used to test the foundation work, which is conducive to the further fine description of reservoir, which is based on the numerical simulation.

V. CONCLUSION

At present, the development trend of reservoir modeling technique is from qualitative to quantitative development, deterministic modeling to stochastic modeling development, single subject research on modeling to the development of multidisciplinary modeling and static data modeling to the dynamic and static data binding model. In order to establish the geological model which is consistent with the actual geological characteristics, it is also to be overcome and improved in the future.

Due to various kinds of modeling methods in the aspects of its basic principle, complexity and application conditions are different, each method has its applicable conditions, advantages and disadvantages. Therefore, how to according to the characteristics described geological phenomena and parameters select appropriate modeling method will be built model to study the difficult and key.

Set up the perfect dynamic and static database, and try to use a variety of data to reduce the uncertainty of the model.

Various methods of reservoir modeling can not be replaced by the knowledge and experience of geological workers. Therefore, it is necessary to strengthen and deepen the basic geological work. Some modeling algorithms are improved so that they can be integrated with different types of information.

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