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Drilling Better Wells Cheaper and Faster

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Abstract

The control of a drill in realtime is demanding on the skills and experience of the drill operator and is variable across operating shifts because different operators have different levels of skill and experience. A mathematical model that could be shared by operators would eliminate this variability but few, if any, exist because of the mathematical difficulty and considerable expense of creating such a model in the first place and then of updating it as geology and hole depth and the type of drilling changes.

This paper describes and demonstrates a radically different approach and a solution to the problem by modelling the operating envelope of the drill operation as a multi-dimensional solid object so that the operating problem becomes a geometric problem of operating always as an interior point of the envelope. The beauty of this approach is that the model developers and maintainers do not need any mathematical knowledge or the ability to describe problems with algebraic or differential equations. The method is able to create models of high dimensionality using the original process variables only so is easily understood and accepted. It is well-placed for realtime exploitation of the increasing number of down-hole measurements. The geometric basis of the model makes the operating advice that it generates intrinsically safe. A realtime operator guidance model will be developed and shown during the presentation to show the concepts, mechanics and possibilities of the method.

The method is part of the overall technology known as Geometric Process Control (GPC) which is becoming well-established in downstream process industries and has already achieved success in problem-solving and offshore process improvement applications with several major North Sea operators. It has won awards for Innovation from EPSC, IChemE, IET and the CIA (Chemical Industries Association).

Introduction

Drilling depends to a large extent on the skill and experience of the individual operator. In many fields where this is the case, efforts have been made to capture the performance of the best operators so that all may achieve the same results. A large effort was put into Rule-Based systems which attempted to formulate skill and knowledge. The approach described here is completely different; the records of good drilling operations on a well are used to automatically build a model that generates advice to the operator.

The operator cannot see 'the edge of acceptability' today but must sense it in some indescribable way commonly labelled as 'skill and experience'. With the new model and its graphic display he is able to see it in realtime and use it to improve his current operation and Rate of Progress. This reduces the 'skill and experience' requirement and simultaneously guides him to perform as well as the experienced operator whose skill and experience form the 'Best Practice' foundation of the model.

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