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REAL-TIME EVALUATION OF MATRIX ACIDIZING TREATMENTS

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Abstract

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As with any stimulation operation, it is important to evaluate the effectiveness of matrix stimulation treatments. This would allow intelligent decisions on the size and type of jobs and their comparison with expected benefits in increased production. In the case of hydraulic fractures the methodology of evaluating the job effectiveness is usually done through pre- and post-treatment well tests. For matrix acidizing such a comprehensive approach is not economically justified for most reservoirs. Hence, the effectiveness of the treatment is gauged by apparent increases in the productivity index, without the benefits of a post-treatment test.

A new technique which is superior to a pre- and post-treatment test sequence and allows the calculation of the initial skin effect, undistorted by acid, and its real-time evolution is presented here. This technique first identifies an appropriate reservoir model and computes the initial skin factor via an injection/displacement/falloff test. Then the method involves the comparison of real-time measured and simulated pressures and the attribution of their reducing difference to the diminishing skin effect. The stimulation job ends when the difference between the measured and the simulated pressure vanishes.

Introduction

The estimation of the well skin effect and the identification of its individual components should be a necessary exercise before a matrix stimulation treatment is undertaken. Only that portion of the skin effect that is due to damage can be removed by a matrix treatment. If the skin effect due to damage has been quantified, then the treatment should reduce the total skin effect by that amount. Further, to be cost-effective, the injected volume and the pumping time should be minimized.

Several attempts have been made in the past to evaluate the effectiveness of a remedial matrix treatment by monitoring the evolution of the skin factor in real time. This monitoring is useful in order to either modify the treatment or to improve future designs in similar situations.

McLeod and Coulter (1969) have presented a method in which the transient reservoir response to the injected fluid is analyzed while the data are collected. The analysis is conducted in discrete intervals because the pressure transients within each interval are dependent on a constant skin effect, the very variable under attack during the treatment.

Paccaloni (1979a, b) understood the concept of continuous skin evolution and presented a

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