

Paper B: Reservoir Characterization during underbalanced drilling (UBD): Methodology and Active Tests

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Summary

Two methods for characterizing reservoir pore pressure and reservoir permeability during UBD while applying active tests are presented and evaluated. Both methods utilize a fast, dynamic well fluid-flow model that is extended with a transient reservoir model. Active testing of the well is applied by varying the bottomhole pressure in the well during the drilling operations.

The first method uses the Levenberg-Marquardt optimization algorithm to estimate the reservoir parameters by minimizing the difference between measurements from the drilling process and the corresponding model states. The method is applied after the drilling process is finished, using all the recorded measurements. The second method is the ensemble Kalman filter, which simulates the drilling process using the dynamic model while drilling is performed, and updates the model states and parameters each time new measurements are available. Measurements that usually are available while drilling are used, such as pump rates, pump pressure, bottomhole pressure, and outlet rates.

The methods are applied to different cases, and the results indicate that active tests might improve the estimation results. The results also show that both estimation methods give useful results, and that the ensemble Kalman filter calculates these results during the UB operation.
