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# Asymptotic analyses of three-dimensional pressure interference tests

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Well test analyses conducted in steady-state and transient flow regimes have complementary strengths and drawbacks. While steady-state analyses are easy to interpret, they do not provide estimates of porosity and are useful only on a late-time portion of the data collected during pressure interference tests. Transient type curve and numerical inverse approaches overcome these shortcomings but are harder to analyze, and their reliability can be affected by changing external forcings. We present our new approach to estimate permeability and porosity from well tests, which is based on an asymptotic analysis of pressure transients during three-dimensional pressure interference tests. Our approach results in a straight line data fitting, rendering the data interpretation straightforward. It also allows one to use intermediate-to-late time pressure data. To illustrate the advantages of the proposed technique, we use it to analyze data from cross-hole pneumatic injection tests conducted in unsaturated fractured tuff. We demonstrate that the equivalent permeabilities and porosities obtained from our analysis compare well with their counterparts inferred from more complicated approaches such as type curve and numerical inverse analyses as well as from a steady-state analysis.