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Analysis of Oscillatory Slug Test Data in Fractures of a High Dip Angle

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A number of cross-borehole slug tests were conducted in a fractured formation. The fractures are highly permeable, as indicated by the oscillatory responses in both the test and nearby observation wells. The fractures under investigation have a high dip angle, and a mathematical model is developed which takes into account the dip angle and the inertial forces in the test and observation wells. For the test well, it is found that (1) the test response does not change significantly when the dip angle is less than about 45 degrees, (2) when the dip angle is larger than 45 degrees; however, the amplitude and the time lag increase with the dip angle, (3) when the dip angle is greater than about 56 degrees, aquifer storativity becomes negligible, as the significant flow due to the dip angle plays a substitutionary role of aquifer storativity, and (4) neglecting the dip angle can result in an overestimate of hydraulic conductivity and an underestimate of aquifer storativity. For the observation wells, the influence of the dip angle is more complicated, depending on the location of the observation well (e.g., up-gradient or down-gradient to the test well, the distance and direction to the test well). In general, the up-gradient test response will have smaller amplitude and larger time lag than does the down-gradient test response.