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Investigation on the Reciprocity Principle with In-Situ Pumping Test in Confined Aquifer

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In this study, the pumping test of reciprocity between wells is developed for 11 wells located on campus of NYUST. The reciprocity analysis is conducted with the heterogeneous hydraulic properties distributions of the site. The mathematical theory of reciprocity implies that choose one as stimulation point and the other as observed response point in two known points at the same random field. Repeat the above action, the response behavior should have the reciprocity between the two points. However, the lack of literature with the field experiment to prove that reciprocity principle. Therefore, this study is expected to investigate the reciprocity of drawdown with the pumping test which will have heterogeneous hydraulic properties distributions obtained by inverse process. In general, there are two ways to investigate the reciprocity of pumping tests of two wells. One way is to evaluate the drawdown reciprocity of two sequential wells. From the evaluation the reciprocity of the drawdown behavior during the sequential pumping wells, the reciprocity of the drawdown behavior is investigated. The other one is to estimate cross-correlation between the drawdown behavior of the sequential pumping wells and heterogeneous hydraulic properties distributions. The reciprocity of between the drawdown and the heterogeneous hydraulic properties distributions is therefore can be investigated. This study proved the reciprocity of drawdown with the sequential pumping test and heterogeneous hydraulic properties distributions obtained by inverse method. Meanwhile, we proved the reciprocity is existed during the pumping test in the confined aquifer.

Keywords: Reciprocity, Cross-correlation, Confined aquifer, Stimulation, Response