

## **Pressure Falloff Testing in Fractured Carbonate Reservoirs**

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### **Abstract**

This work focuses on the use of pressure falloff tests to reduce geological uncertainties about effective reservoir permeability and wellbore induced fractures in an Omani field. These uncertainties resulted in construction of a 3D reservoir simulation model which could not be history-matched dynamically without using high permeability and transmissibility multipliers. These multipliers are in fact much higher than the actual core measurements. Furthermore, two recent studies worked on analyzing a number of well tests showed significantly different results. The field under study has a massive infrastructure for data collection and transmission with a powerful system called Shurooq to monitor the performance of water injectors. However, Shurooq uses surface pressure gauges that have major limitations in terms of accuracy and data storage. Hence, it was required to investigate other alternatives to improve reliability of the data. In order to improve understanding of the field and quality of the data pressure falloff tests were conducted in three water injection wells using three different acquisition methods. These were Low Resolution Surface Gauge (Shurooq), High Frequency Surface Gauge (HFSG) and downhole gauge coupled with Downhole Shut-in Tool (DHSIT). Considering the field-specific uncertainties (geological and operational) the tests were simulated and designed to ensure reliability. The results obtained were interpreted using the log-log pressure derivative diagram. The results with previous studies that led to the field division into fracture and matrix dominated injection areas. Moreover, the results support the core measurements implying the need to reconstruct the reservoir model to reflect the actual geology of the field. In terms of the acquisition methods investigated, the DHSIT provided the most reliable data but at the highest cost. Nevertheless, Shurooq provided acceptable estimates for the permeability ( $k$ ), skin ( $S$ ) and

average reservoir pressure ( $P_i$ ). The results obtained from all tests were utilized to generate correlations that can be used to estimate the wellbore and reservoir parameters from surface measurements. These correlations will make it possible to use Shurooq for acquiring all future pressure falloff tests in the field.