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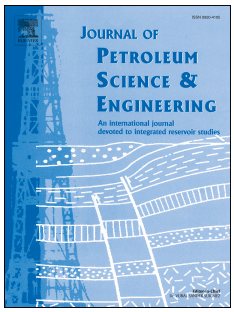

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A Generalized Framework for Capacitance-Resistance Models and a Comparison with Streamline Allocation Factors

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Abstract

The Capacitance Resistance Model (CRM) is a fast way for modeling and simulating gas and waterflood recovery processes, making it a useful tool for improving real-time flood management and reservoir analysis. CRM is a material balance-based model that requires only injection and production history, which are the most readily available data gathered throughout the production life of a reservoir. In this work, state-space (SS) equations are derived to describe the dynamic behavior of several CRM representations as a multi-input/multi-output system (matrix representation), computing reservoir dynamics simultaneously as a single system with interactions between injectors and producers.

Interwell connectivities, time constants and productivity indices are estimated using a grey-box system identification algorithm. The matrix form of the CRM history matching and a sensitivity analysis to the CRM parameters estimates are presented. This process is computationally fast and easy to apply in fields with a large number of wells. Two case studies validate the proposed methodology: (1) homogeneous reservoir with flow barriers; and (2) channelized reservoir. A comparison between streamline allocation factors and CRM interwell connectivities for every injector-producer pair in the case studies is included to clarify their physical meaning, similarities and differences.

The results lead to the following findings: 1) there is a fair correlation between CRM interwell connectivities and streamline allocation factors but