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Message Passing Neural Network (MPNN) Approach to Multiphase Diffusion in Reservoirs for Well Interconnection Assessments

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Abstract : Automated learning techniques are widely applied in the energy sector to address challenging problems from a practical point of view. To this end, we discuss the implementation of a Message Passing algorithm (MPNN)within a Graph Neural Network(GNN)to leverage the neighborhood of a set of nodes during the aggregation process. This approach enables the characterization of multiphase diffusion processes in the reservoir, such that the flow paths underlying the interconnections between multiple wells may be inferred from previously available data on flow rates and bottomhole pressures. The results thus obtained compare favorably with the predictions produced by the Reduced Order Capacitance-Resistance Models (CRM) and suggest the potential of MPNNs to enhance the robustness of the forecasts while improving the computational efficiency.

Keywords : multiphase diffusion, message passing neural network, well interconnection, interwell connectivity, graph neural network, capacitance-resistance models
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