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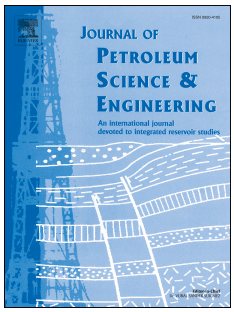

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Mixed-Integer Programming Models for Line Pressure Optimization in Shale Gas Gathering Systems

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In this work we propose a mixed-integer nonlinear programming model to address the line pressure optimization problem for shale gas gathering systems. This model is designed to determine: a) the optimal timing for turning prospective wells in-line, b) the optimal pressure profile within a gathering network, and c) the necessary compression power for delivering produced gas to long-distance transmission lines.

We rely on a pressure-normalized decline curve model to quantify how line pressure variations impact the gas production of individual wells. The reservoir model itself is incorporated in a transmission optimization framework which rigorously evaluates pressure drops along pipeline segments. Moreover, we explicitly consider compression requirements to lift line pressure from gas gathering levels to setpoints dictated by transmission pipeline companies. Since the resulting optimization models are large-scale, nonlinear and nonconvex, we propose a solution procedure based on an efficient initialization strategy. Finally, we present a detailed case study, and show that the proposed optimization framework can be used effectively to manage line pressures in shale gas gathering systems by properly scheduling when, and how many, new wells are brought online.

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