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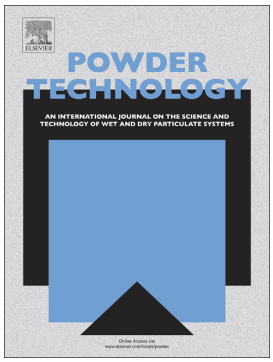

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Pressure drop in pipe flow of cemented paste backfill: Experimental and modeling study

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Abstract: Advances in pipe transportation have contributed significantly to the application of cemented paste backfill (CPB). However, the pressure drop during pipe transportation with complex circuit shapes has not been fully investigated. Currently, research in the field is largely experiment-centered, where extensive test loop experiments need to be performed for a specific CPB material. By comparison, computational modeling of the pressure drop during pipe transportation through complex circuits is still in its infancy and is hindered by the challenges of technique availability and data scarcity. In this article, we present a framework for investigating and modeling the pressure drop of CPB during pipe transportation with complex circuit shapes. A test loop system was used to investigate the pressure drop of CPB under different influencing variables. Based on the experimental data, gradient boosting regression tree (GBRT) was utilized to develop a prediction model for the CPB pressure drop in the pipe loop. We first discussed the effect of solids content, cement–tailings ratio, inlet pressure, and circuit shape on the CPB pressure drop. The feasibility of GBRT modeling was demonstrated by comparing the predicted pressure drop with the experimental result on both the training and testing sets. We also investigated the relative importance of influencing variables on the pressure drop of CPB. Harnessing such a modeling approach extends recent efforts to determine the pressure drop during CPB pipe transportation and can significantly accelerate the application of CPB in the future.

Keywords: Pipe flow; cemented paste backfill; pressure drop; test loop; gradient boosting regression tree; variable importance.