

Modeling and Simulation of the Consolidation Behaviour of Cemented Paste Backfill

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Abstract

In underground mining operations, the mined-out spaces (called stopes) need to be backfilled to maintain the stability of surrounding rock mass and increase the ore recovery. Cemented paste backfill (CPB), a mixture of water, binder, and tailings, has been intensively utilized in underground mining operations to fill the stopes. After preparation, the fresh CPB is transported into stopes via gravity and/or pipelines. The CPB in stopes is subjected to thermal, hydraulic, mechanical and chemical loads. As a result, the consolidation behavior of CPB is dominated by complex multiphysics processes that occur within the CPB. However, the conventional consolidation theory mainly focuses on the coupled mechanical and hydraulic process. Therefore, it is necessary to develop a multiphysics model for the assessment and prediction of the consolidation behavior of CPB.

In the study, a 3D coupled multiphysics model is proposed and implemented using COMSOL Multiphysics® software. The predictive capability of the proposed model is validated against experimental data collected from well-controlled laboratory experiments. The Geomechanics Module, Subsurface Flow Module, and Heat Transfer Module are used. The prediction results show a good agreement with the measured data, which verifies the predictability of the developed model.

Reference

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Figures used in the abstract

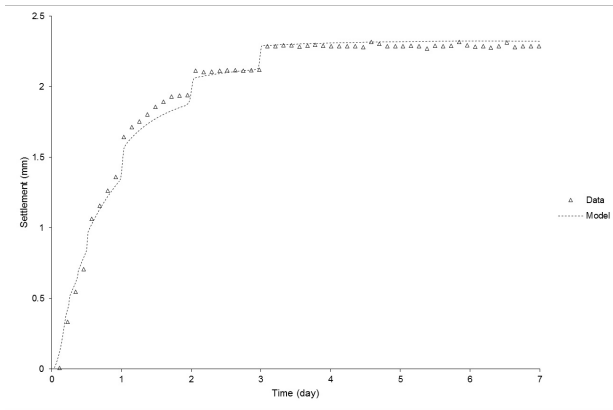


Figure 1: Comparison between simulated results and experimental data of settlement.

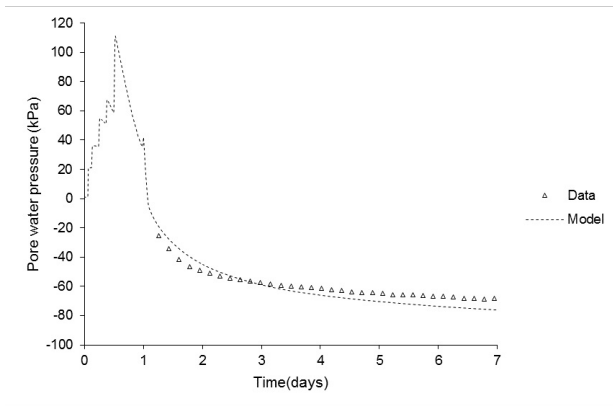


Figure 2: Comparison between simulated results and experimental data of pore water pressure.

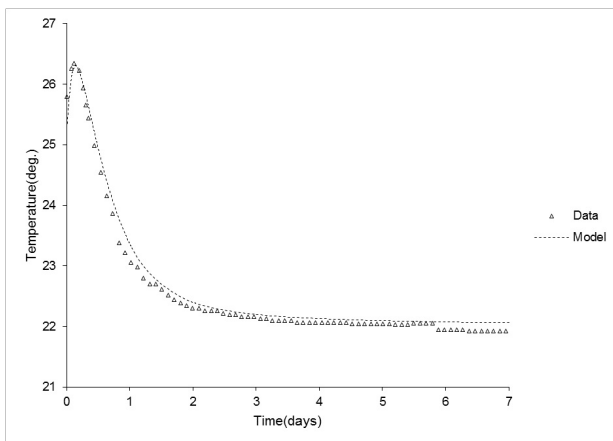


Figure 3: Comparison between simulated results and experimental data of temperature.