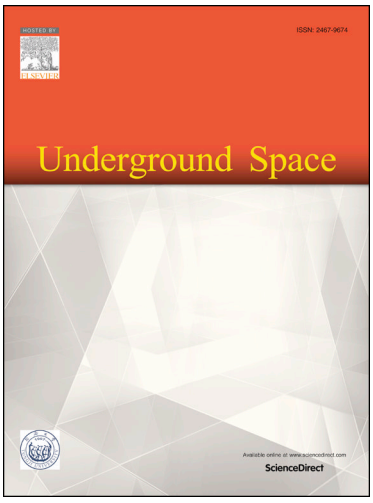

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3D FINITE ELEMENT MODELLING OPTIMIZATION FOR DEEP TUNNELS WITH MATERIAL NONLINEARITY

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Abstract

3D modeling of tunnels using a nonlinear ground model is still a time-consuming task because it usually requires a large number of incremental phases with iterative processes, to ensure accuracy while minimizing computational effort. Optimization of the finite element mesh is of utmost importance. Despite the current tendency towards 3D modeling of tunnels, few publications are concerned with mesh optimization considering model size, grid refinement and order of elements. This paper improves the understanding of key issues that affect 3D modeling of tunnels. Our results shown that: (1) 2nd order elements are more efficient when material nonlinearity is present and should be preferred; (2) the plastic zone size has a strong influence on the model dimensions and may require discretizations much larger than those currently accepted. The paper provides recommendations for mesh refinement and model dimensions (width and length) as a function of the plastic zone size, for accurate 3D models with reduced computational cost.

Keyword: tunnel, numerical modeling, finite element method, mesh optimization, nonlinear material