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Spatially Variable Coal Slope Stability Analysis using Image-Based Scaled Boundary Finite Element Method

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Slope stability analysis is a challenging task when complex stratigraphies, complex geometries and spatially variably soil parameters are considered. Numerical methods, such as the finite element method are commonly used in slope stability analyses, however these methods require significant user input when meshing geometries consisting of heterogeneous and spatially variable materials. This paper presents a numerical technique combining the scaled boundary finite element method and image-based meshing for slope stability analysis. The inputs for the analyses require images detailing the strata and the spatial variation of the material properties within the strata. Quadtree decomposition was applied to simultaneously generate meshes and consider the spatial variation of material properties directly from the images through a mapping technique. The stability of slopes were analysed assuming an elasto-plastic Mohr-Coulomb constitutive model for the soil. The shear strength reduction technique is applied to evaluate the shear reduction factor iteratively to define the factor of safety of the stable slope. Coal slope at Yallourn open-pit mine,Victorial, Australia was used as a case study to demonstrate the application of the presented method.