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THREE-DIMENSIONAL STABILITY ANALYSIS OF A TUNNEL DRIVEN IN JOINTED ROCK THROUGH A HOMOGENIZATION METHOD

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Abstract. Conceived as a potential alternative to the classical design methods for stability analysis of underground structures driven in jointed rocks, the homogenization approach stems from the heuristic idea that, from a macroscopic point of view, a rock mass cut by a network of joints may be perceived as a homogenized continuum whose strength properties of the latter can theoretically be obtained from the failure conditions of its individual constituents.

The present contribution investigates the stability analysis of a tunnel driven in a jointed rock mass within the framework of a homogenization method. The method relies upon an explicit formulation of the macroscopic strength condition for the jointed rock.

At the material level, the method relies upon an explicit formulation of the macroscopic strength condition for the jointed rock mass viewed as a homogeneous anisotropic material due to joint preferential orientation. The support functions (-functions) associated with the homogenized strength criterion are also determined in both plane strain and three-dimensional cases. At the structure level, this criterion is then applied to analyze the stability of a tunnel excavated in a jointed rock mass. Upper bounds estimated of the stability factor are derived from the implementation of the kinematic approach directly on the homogenized underground structure. Finally, the approach is applied to analyze and discuss collapse of the Pinheiros subway Station (São Paulo – Brazil).