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A Micromechanical-Based Constitutive Model for Fibrous Fine-Grained Composite Soils

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ABSTRACT

Composite soils such as municipal solid wastes (MSWs), peats, and reinforced soils are generally composed of multiple phases with different properties. Numerical modeling of these soils which takes the individual constituents into account might be impractical as it requires great computational efforts. Hence, geotechnical practitioners may prefer to treat a representative material which accounts for the whole mechanical aspects of the composite soil. In the current study, a constitutive model has been developed which treats the fine-grained composite soils in two general phases: matrix (paste) and fiber. To represent the behavior of these phases, two distinct constitutive models are used: (1) an anisotropic critical state-based constitutive model for matrix phase and (2) a Von-Mises type model for fiber phase. In order to consider the composite soil as a single phase homogeneous material, a volumetric homogenization procedure is used based on the micromechanical theories. Accordingly, strain concentration tensor is developed which determines the equivalent stiffness tensor for the homogenized soil. Based on the hypotheses derived from the experimental observations, the basic model is gradually enhanced in order to account for some important aspects of composite matters including fibers orientation,

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