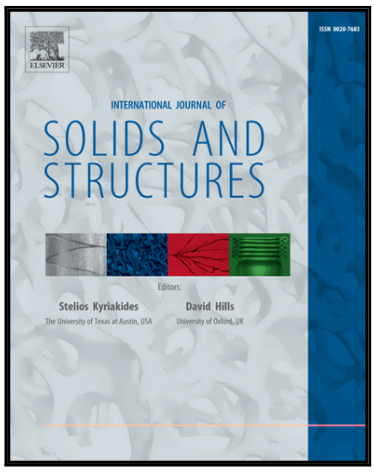

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A model for natural lumpy composite soils and its verification

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Abstract

Fresh lumpy soils from open-pit mining have a relatively open structure, which transforms gradually into a lumpy composite structure due to weathering factors. The resulting lumpy composite soils consist of natural stiff lumps and a reconstituted soil within the inter-lumps space. The stress and strain distributions are not uniform, since there is a significant difference of the stiffnesses for these two constitutes. The lumpy soils with a composite structure are investigated in this paper, both experimentally and theoretically. First, the volume of the lumpy composite soil is divided into separate parts and the evolution of the volume fraction of the lumps is considered. A nonlinear Hvorslev surface considering soil structure is proposed for the lumps on the dry side of the critical state and evaluated based on laboratory data. Finally, a simple model for the lumpy soils is proposed within a homogenization framework. Comparisons between the experimental data and simulations reveal that the proposed model can well represent the stress-strain and volume deformation behaviour observed in the laboratory.

Keywords: Open-pit mining; landfills; lumpy soil; homogenization framework

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