Nonlocally Regularised Stress-Fractional Plasticity Model Considering Fabric Anisotropy

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KEYWORDS: *Nonlocal Regularization, Fractional Plasticity, Fabric Anisotropy, Numerical Methods.*

Stress-Fractional and non-orthogonal plasticity models are capable of capturing the state-dependent nonassociated behaviour of soil without using additional plastic potential or even state index in some circumstances; however, their performances in finite element analysis involving softening and strain localization can be highly sensitive to mesh discretization, thereby compromising the reliability and accuracy of the results. To this end, a nonlocal regularised two-surface stress-fractional plasticity model is proposed, where a basic simplification criterion for the practical modelling in general stress condition is suggested. Given the critical role of plastic volumetric strain in simulating strain softening, its evolution is assumed to be governed by increments at both local and neighbouring integration points. The regularization method is implemented via a user-defined subroutines using an explicit stress integration scheme, where the nonlocal model is applied to simulate boundary value problems involving over-consolidated clay under biaxial compression, cut slope, and strip footing bearing capacity. When compared to the original model, the nonlocal model substantially reduces mesh sensitivity in the load-displacement response and produces more consistent soil failure patterns, validating the effectiveness of the nonlocal approach.

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