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Incremental Nonlinearity in Constitutive Relation for Granular Media

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Recently, incrementally nonlinear models have been proposed for constitutive relations of geomaterials. To validate such constitutive models, we have to develop a sophisticated testing apparatus. Furthermore, to investigate general irrecoverable behaviors, we have to conduct a huge series of tests for numerous specimens regarded as identical. On the other hand, numerical tests with a suitable discrete element method enable us to extract general information on irrecoverable behaviors of an identical granular specimen. In this paper, the 3D Granular Element Method was utilized to conduct stress probe tests. It was found from these tests that, as far as the conventional tri-axial state concerns, the incremental plastic response is approximated by the non-associated flow rule, and that, for general true tri-axial stress-probes, the direction of incremental plastic strain is apparently dependent on the direction of incremental stress. The latter suggests the existence of multiple shear mechanisms in plastic deformation of granular media.

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