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A kinematic hardening soil model for wide shear strain ranges

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SUMMARY

A plane strain elasto-plastic kinematic hardening constitutive equation for frictional materials has been constructed based on the power law for small strain shear modulus, the Mohr-Coulomb type shear strength law and the normalized shear modulus reduction function which relates the normalized shear strain and the normalized shear modulus for a wide range of strains. The elastic shear modulus and elastic shear strain at failure were used as normalizing parameters. The proposed normalized shear modulus reduction function as a unique material function arises from recent laboratory research on stress-strain behaviour of soil specimens tested with high resolution local strain transducers which shows that the static and dynamic shear stiffness of soils follow the same pattern. Published data on the stress-strain response of Toyoura sand under cyclic and monotonic loading were used for the construction of the normalized modulus reduction function in static and dynamic analyses. The Masing type behaviour for cyclic loading is introduced by a series of simple elasto-plastic parallel elements which may be easily adjusted to the given normalized shear modulus reduction function. All model parameters can directly be obtained from standard laboratory tests.