Plasto-damage model for stress-strain behavior of soil

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Abstract

A Plasto-damage model for the stress-strain behavior of soil, subjected to triaxial test conditions is presented in this research. The model uses the damage mechanics technique combined with plasticity for local cohesive and non-cohesive types of the soils. This research is particularly suitable for the soils showing post-peak strain-softening type stress strain behavior. A continuum damage mechanics based elasto-damage formulation is used in combination with the plastic formulation to predict the experimental stress-strain post peak strain-softening behavior. Two different methods were used to combine the effect of plasticity with damage formulation.

The work done was based on the concept that at a particular stress level the strain is composed of three parts, the elastic strain, damage strain and plastic strain. The material has purely elastic strains as long as it is within the linear elastic range. The damage and plastic strains start as soon as material enters the damage region and plastic region respectively. Combined together these strain components give the total required strains. The formulation suitable for conventional triaxial test for both damage and plastic models are derived.

To implement the model, parameters are calibrated form the results obtained from the extensive experimental program. The conventional triaxial test at different confining pressures, isotropic compression tests and unconfined compression strength test were done at different density values for cohesive and non-cohesive types of soils.

The Numerical model is coded in a FORTRAN programs to calibrate the model parameters and then simulate the experimental stress-strain behavior. The model predicts the stress strain behavior very well.