

Automatic determination of material parameters

Background

Plaxis 3D is a system for creating, calculating and evaluating 3D models of soil and structures, such as tunnels, dikes and skyscraper foundations. Part of this system is a Material Database, which contains entries for different materials. Materials are parameterised entities, with properties such as strength and stiffness. Every material instigates different behaviour and interaction with other materials, according to the values of its parameters.

Knowledge of the soil model is obtained by probing the soil of a construction site, and then performing lab tests on the resulting samples. From the lab tests, a number of properties for a soil material can be determined, such as weight, cohesion and shear strain. Soil properties are related to each other, and, if sufficient information is available, it is possible to calculate the unknown properties. It is favorable to calculate the remaining properties, instead of determining them by performing additional, time-consuming lab tests.

Problem definition

Calculating the remaining properties is essentially a constraint satisfaction problem, that can be solved by analysis. The goal of the constraint solver is to find a unique set of soil parameters that satisfies the already determined properties, and leaves no unknown properties for the material. If no unique set of soil parameters can be found, the problem is ill-constrained, and additional lab tests are required.

Project goals

This project comprises the implementation of a constraint solver for determining a subset of soil material parameters for a particular material. The values of the soil material parameters that have been determined by probing and lab tests are used as input for the constraint solver.

The results must eventually be exported to the Material Database.

How to apply

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