SEEQUENT
SIGMA/W
Stress and Deformation Analysis
GeoStudio

SIGMA/W is a powerful finite element software product for modeling deformation and stability in the civil and mining sectors. SIGMA/W analyses may range from simple linear elastic imulations to soil-structure interaction problems with nonlinear material models.

Stress History

In Situ stresses can be established using gravity activation, field stresses, or the K0 procedure, which consider the volumetric water content function to determine effective stresses in the unsaturated zone. Pore-water pressures can be defined using a variety of sources.

Coupled Consolidation

The coupled stress and pore-water pressure formulation can handle complex analyses with saturated or unsaturated soils. This is useful for construction sequences involving fill placement, excavation, and soil-structure interaction.

Load-Deformation

Unloading or loading activities can be simply and accurately modelled, including submerged fill placement, dam and tailings embankment construction, deep excavations, and open pit mine construction. Pore-water pressure changes can be incorporated by defining the initial and final water conditions.

Stress Redistribution

The stress redistribution algorithm is capable of doing stress correction for any material model with a failure criteria. Strength Reduction Stability is also available as an alternative to the limit equilibrium stability method.

SIGMA/W offers simple but powerful analytical capabilities when used in combination with other GeoStudio products.

SIGMA/W stresses in SLOPE/W

There are many geotechnical cases where it is desirable to not only perform a deformation analysis, but also to look at stability. In other instances, a SLOPE/W limit equilibrium stability analysis alone is inadequate. For cases like this, the SIGMA/W computed stresses can be used in SLOPE/W to compute the safety factors.

SIGMA/W integration with SEEP/W

Excess pore-water pressures generated in SIGMA/W by external loads (e.g. fill placement) can be used as initial conditions in a transient SEEP/W analysis. The simulated dissipation rates can be used to develop construction staging schedules. SEEP/W pore-water pressures can be used by SIGMA/W to simulate *in situ* effective stresses.

SIGMA/W stresses in QUAKE/W

Establishing in situ static stresses can be done simplistically in QUAKE/W. Alternatively, you can use the load sequencing and non-linear constitutive soil models in SIGMA/W to improve the estimation of the static stress conditions. These stresses can be used by a QUAKE/W dynamic analysis as the initial static conditions.

SIGMA/W models a full range of deformation problems

Staged fill or excavation design

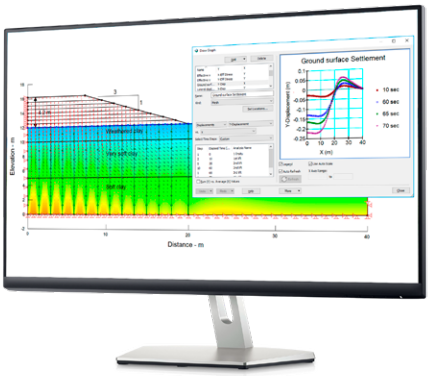
The rigorous stress-strain formulation of SIGMA/W, and the seamless workflow of GeoStudio, simplifies the analysis of complex staged construction problems involving cut slopes and fill placement. Simulations of this nature are required to simulate the construction of earth and rock fill embankments, tailings dams, railway and roadway cuts, and more. SIGMA/W's coupled stress-strain and water transfer formulation makes it possible to also analyze the simultaneous generation and dissipation of excess porewater pressures, allowing for the design of sub-surface drainage systems with the software.

Stability and deformation of slopes

SIGMA/W can be used to model the deformation of natural and cut slopes under a variety of loading conditions resulting from changes to the groundwater flow system, strength loss due to strain-softening, and construction activities. SIGMA/W's Strength Reduction Stability (SRS) technique can be used to calculate a safety factor against failure while simultaneously providing information about deformations resulting in strength loss.

Reinforcement and slope stabilization

Deep excavations for civil, geotechnical, and mining applications often involve complex soil-structure interaction. The rigorous structural element formulations, combined with a comprehensive material model library, make SIGMA/W the ideal tool for modeling struts, pile and sheet walls, anchorage, tunnel lining, and more. SIGMA/W's Stress Redistribution analysis also makes it possible to simulate load transfers and structural responses for projects involving slope stabilization by means of engineered structures (e.g. soldier pile wall). In all cases, SIGMA/W can be used to ensure that the structures are designed to safely carry the loads and to ensure that overall stability is established with an acceptable margin of safety.



GeoStudio

SIGMA/W comprehensive feature set

- Comprehensive incremental stress-strain formulation
- Rigorous stress-update algorithm for handling non-linear material models
- Coupled stress and pore-water pressure formulation
- Straightforward construction sequence simulation
- Multiple options for in situ stress definition
- Saturated-unsaturated formulation
- Comprehensive constitutive model list including non-linear soil and rock material models
- Estimation routines for typical material properties
- Complete range of boundary conditions
- Expansive structural element library
- Stress redistribution analysis
- Automated strength reduction stability
- Integration with SLOPE/W

SEEQUENT

A better understanding of the earth creates a better world for all

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