UDEC™ VERSION 7.0

Distinct-Element Modeling of Jointed and Blocky Material in 2D

ABOUT *UDEC*

UDEC is numerical modeling software for advanced engineering analysis of soil, rock, blocky structures, and structural support in two dimensions. *UDEC* simulates the response of discontinuous media (such as jointed rock or masonry structures) that are subject to either static or dynamic loading.

A discontinuous medium is modeled as an assemblage of polyhedral blocks that may be rigid or made deformable through zoning. Fractures are treated as boundary conditions between blocks. Motion along discontinuities is governed by linear and nonlinear force-displacement relations for movements in both the normal and shear directions.
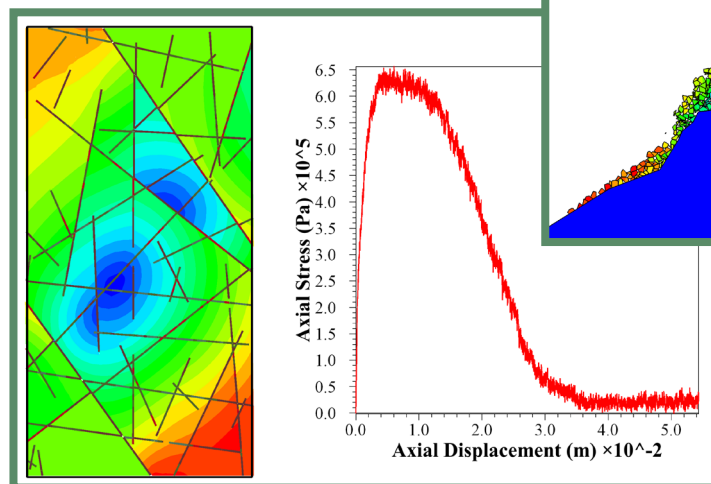
FEATURES

GENERAL

- Designed to accommodate any kind of analyzes of jointed, blocky systems
- Simulates and tracks large displacements, including slip and opening, along a discontinuous medium (e.g., jointed rock mass, damage models of intact materials)
- Models may contain a mixture of rigid or deformable blocks
- Permits both discrete element and continuum analyses
- Fluid or gas flow can be simulated within fractures of a system of impermeable blocks
- Confined flow, transient flow, two-phase flow and flow with a free surface can be modeled
- Includes a built-in scripting language (*FISH*) and text-editor to customize or automate virtually all model properties and parameters
- Excavation, backfill simulation, and "infinite domain" problems can be modeled
- Coupled mechanical-hydraulic-thermal-dynamic analysis is possible
- Libraries of materials and constitutive models for deformable blocks and joints are included
- Licenses: network, standard, and lease
- Standard license may move between multiple computers
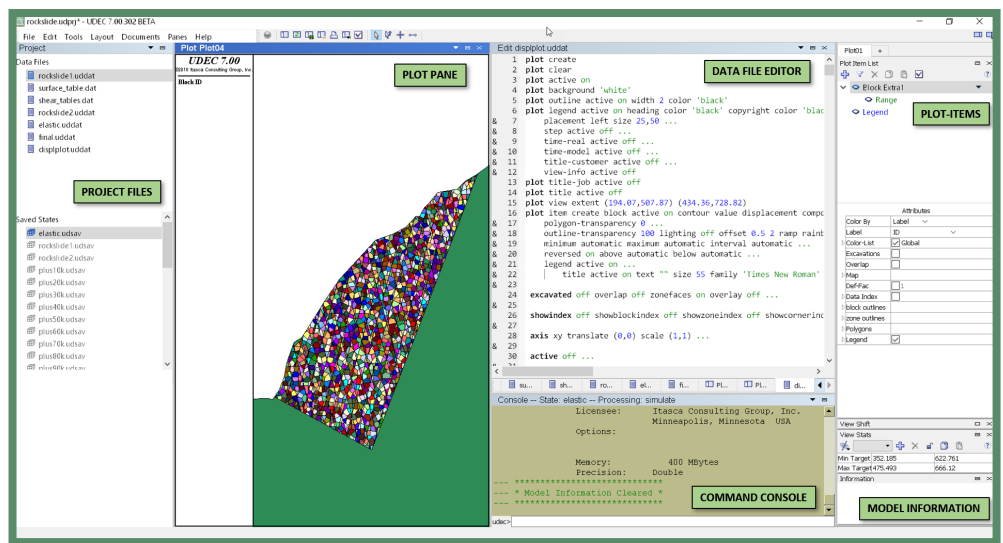
The new, optional *UDEC* 7 graphical user interface provides pre- and post-processing tools, model analysis functionality, advanced plotting capabilities, file management tools, and a built-in data file editor. Multiple preset layouts are available; custom layouts may be saved. The familiar *UDEC* GIIC, with interactive modeling tools and project tree, is also available if preferred.

Discrete Fracture Network (DFN) generation tools, based on a statistical description, are now available Fractures are generated until a specified stopping criterion is met (count, borehole frequency (P10), mapping density (P21), connectivity, etc.)

The new GUI features improved plotting and new plot-items.

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USER INTERFACE

- Now available in two flavors with access to the best of two worlds: the familiar *UDEC* GIIC[1] with interactive modeling tools and project tree and the new *UDEC* GUI[2] framework with advanced graphics and processing tools used by Itasca's 3D software
- *UDEC* 7 data and save files can be exchanged between each program
- Designed to facilitate model work flow by building and solving a series of construction stages
- Extensive run-time monitoring of results and post-analysis capabilities
- Apply commands and *FISH* interactively via the user interface or ASCII data files

BOUNDARIES/CONDITIONS

- Displacement and stress boundaries
- Construction joints may be welded to aid model building or permit the simulation of joints that end within blocks
- Structural elements for ground support, such as cables, beams (e.g., concrete lining, shotcrete, and steel sets), and 1D support members (e.g., hydraulic or wooden props or packs)
- Water table can be defined to model effective stress and ground water flow
- Absorbing (quiet) and free-field boundaries and seismic wave input are all available in dynamic mode

GEOMETRY

- Visual model geometry tools (GIIC)
- Virtual grid manipulation (GIIC)
- Import grid geometry from CAD data
- Library of pre-built geometries (GIIC)
- Includes automatic statistical joint set and Voronoi tessellation generators
- Automatic generation of zones within deformable blocks
- Axisymmetry analysis

MATERIAL MODELS

- Joint contact models include point, Coulomb slip, residual, glued, and continuously-yielding
- Fourteen material models are built-in for deformable blocks:
  - Null,
  - Isotropic elastic,
  - Transversely isotropic elastic,
  - Drucker-Pager,
  - Mohr-Coulomb,
  - Ubiquitous-Joint,
  - Strain-Softening/hardening,
  - Softening-ubiquitous,
  - Double yield,
  - Modified Cam-clay,
  - Hoek-Brown,
  - Hoek-Brown-PAC,
  - Cap-Yield (cysoil), and
  - Cap-Yield-simplified (chsoil)

SOLUTIONS

- Boundary relaxation tool to simulate the 3D effect of an advancing tunnel
- Automatic Factor of Safety calculations, including water, structural support elements, material and joint properties
- Both domain and cell space detection logic
- Energy changes can be measured for intact rock, the joints, and for the work done on boundaries
- Includes thermal analysis to simulate transient heat conduction in materials and the development of thermally induced displacements and stresses
- Both implicit and explicit thermal calculation schemes are available
- Includes dynamic analysis for seismic, blasting and earthquake simulations

NEW FEATURES

- Optional, new user interface (GUI) with updated plot-items and powerful pre- and post-processing tools
- All commands and *FISH* scripting updated to make syntax clearer, more consistent, intuitive, and easier to use
- The new GUI includes new *FISH* capabilities and tools:
  - Global Symbols Control Set displays real-time value of *FISH* variables
  - Built-in text editor designed for *UDEC* commands and *FISH* syntax
  - New data types like vector, tensor, matrix, and boolean
  - Zone quality metric
  - Email functions
  - Local and global variables
  - Inline *FISH* allows snippets to be inserted within commands
  - Improved structural element *FISH*
- New model construction tools:
  - Topographic stress initialization
  - Automatic stress initialization from a point value
  - Automatic block generation for bricks and asymmetric voronoi
  - Create, import, and export geometric data for cutting, range logic filtering, and visualization
  - Crack models using DXF files
  - Discrete Fracture Network (DFN) tools to generate and work with complex joint sets
- Better Analysis
  - Factor of Safety contouring using the strength reduction method
  - Added rockbolt structural elements that are able to resist moments
  - GUI interactive model querying for model element information
  - New track command shows a model element's position over time
- More GUI Help (in console or editor) via *F1-key* for contextual guide or *Ctrl + space* bar for line completion

- New built-in technical support dialog
- Dynamic Input Wizard to facilitate input signals preprocessing for seismic and dynamic analyzes

AVAILABLE OPTIONS

- **Barton-Bandis empirical joint model** to describe the effects of surface roughness on discontinuity deformation and strength
- **Thermal analysis** for transient heat conduction in materials, and the development of thermally-induced displacements and stresses
- **Creep material model** to simulate time-dependent behavior
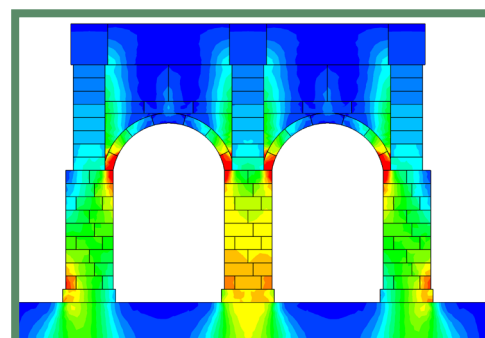- Custom constitutive C++ **User-Defined Models** (UDM)

TRY THE DEMO

Itasca is pleased to offer free demo versions, with some limitations, of all software for download.

www.itascacg.com/demos

ORDER SOFTWARE

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www.itascacg.com/sales

▲ *UDEC* is a popular choice for modeling masonry structures. Contours of vertical stress are shown.

▼ Bonded voronoi blocks can be used to model damage to intact rock around excavations.