



## UDDEC™ VERSION 5.0

Advanced, Two Dimensional Discrete Element Modeling  
for Geotechnical Analysis of Rock, Soil, and Structural Support

### SUMMARY

#### Suggested System Minimums

Windows XP, Windows Vista, Windows 7;  
1 GB free space on hard drive; 512 MB RAM;  
Graphics card with OpenGL 1.3 or higher;  
1GHz or better processor

#### Standard License Includes

UDDEC Version 5.0 on accompanying installation  
CD, softbound book and PDF copies of the *UDDEC  
Manual: User's Guide, Command Reference, FISH  
in UDEC, Theory and Background, Special  
Features, Verification Problems, Example  
Applications, Creep Material Models, Constitutive  
Models; UDEC code security via USB hardware  
lock*

#### Separate Options Available\*

Barton-Bandis, UDM/UDMJ

\*These options are included at an additional cost

#### Support

Free: code updates and support information  
via web site; free direct support for code  
installation and general code operation.

Fee-based: Engineering/problem-solving  
support.

#### Sales

Varies with Location: Locations of Itasca offices  
and agents throughout the world, including a  
locator to determine the user's *UDDEC* sales  
office/agent, are available from the Itasca web  
site: [www.itascacg.com/software/sales.php](http://www.itascacg.com/software/sales.php)

Distributor for Italy

**HARPACEAS**

Viale Richard, 1 20143 Milano - Italy -  
Tel +39 02 891741 Fax +39 02 89151600  
info@harpaceas.it • www.harpaceas.it

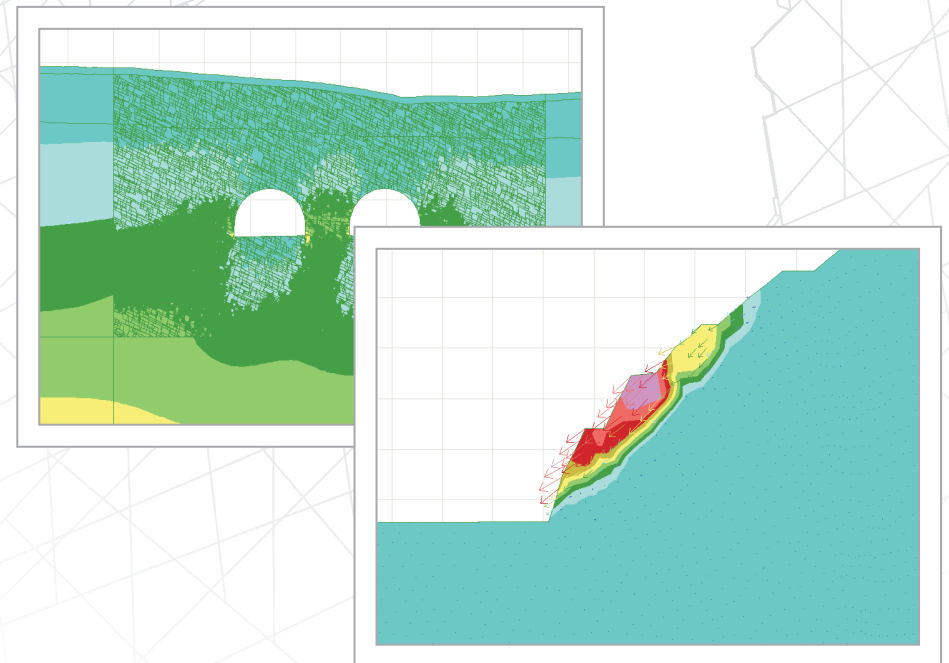
For more information, visit our site:

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software@itascacg.com



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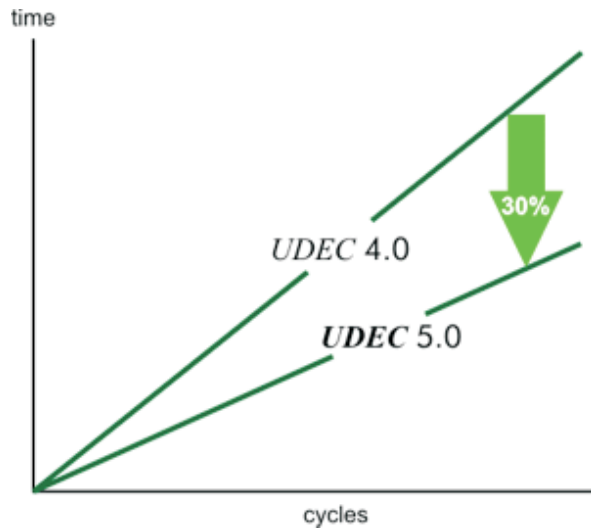
# ABOUT UDEC

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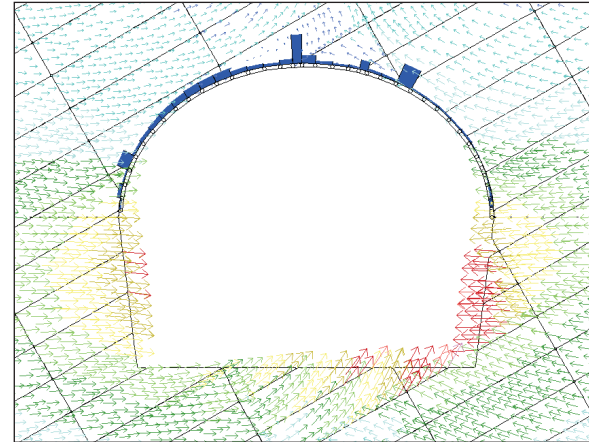
UDEC is an advanced, two dimensional discrete element modeling code for geotechnical analysis of soil, rock, and structural support in three dimensions.

UDEC is used in analysis, testing, and design by geotechnical, civil, and mining engineers. It is designed to accommodate any kind of geotechnical engineering project where analysis of jointed, blocky systems is necessary.

UDEC utilizes an explicit solution scheme that can model complex, non-linear behaviors. It simulates either the quasi-static or dynamic response to loading of rock media containing multiple, intersecting joint structures. Because it is not limited to a particular type of problem or initial condition, UDEC may be applied to any case where an understanding of the two-dimensional response of such structures is needed.

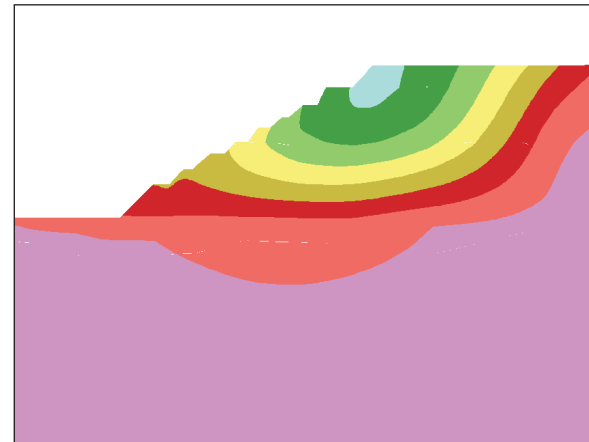


▲ Speed increases up to 30% faster than the previous version



▲ Color-scaled displacement vector field in a tunnel model using the improved structural liner. The Axial force on the liner is shown in blue.

▼ Displacement magnitude contours.



# OPTIONS

**UDEC FACTS**

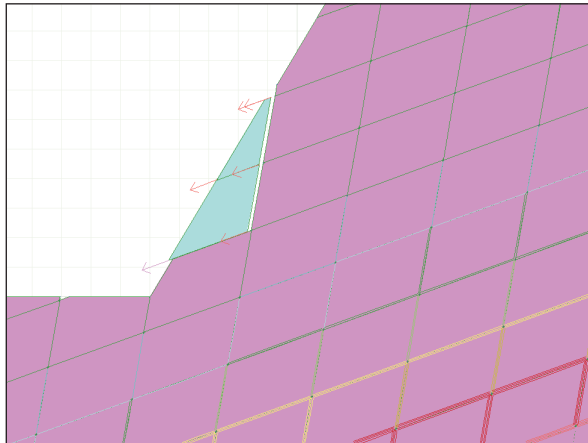
In addition to the extensive documentation that appears in the manual provided with the program, *UDEC* is supported through Itasca's web site in a number of ways, including: free program updates, demonstration versions, movies illustrating code features, alerts for known issues in the code, and more. Visit the *UDEC* section of the web site: [www.itascacg.com/udec](http://www.itascacg.com/udec)

Options in *UDEC* are sold separately from the code license, allowing users to augment the program's functionality according to their analysis needs. Modules available as options for *UDEC* are Barton-Bandis and User Defined C++ Constitutive Models.

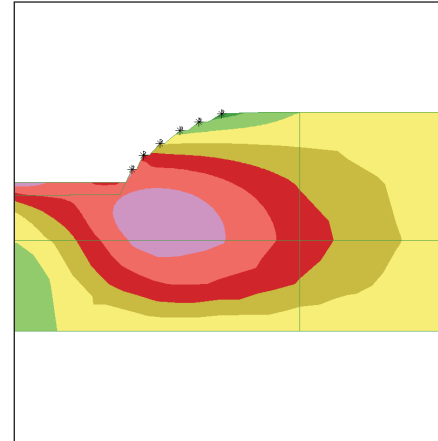
The Barton-Bandis model is a series of empirical relations that describe the effects of surface roughness on discontinuity deformation and strength. The model provides calculations for joint normal behavior and joint shear behavior. The Barton-Bandis model is an option that is available with the code at an additional cost.

The User-Defined C++ Constitutive Model option allows users to write and compile their own models as DLLs that can be loaded whenever needed. Models may be shared with other Itasca codes. New DLL models can be obtained from the Itasca web site devoted specifically to model development and exchange: [www.itasca-udm.com](http://www.itasca-udm.com).

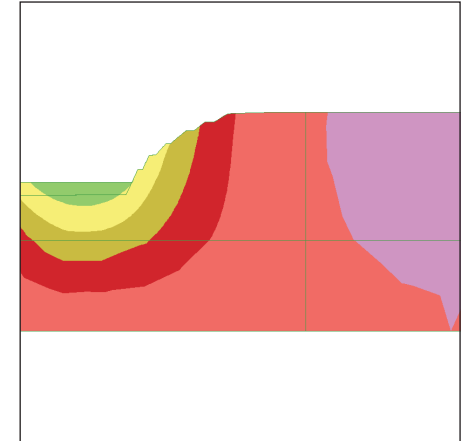
▼ **Slope flow.**



BACK ANALYSIS OF A SMALL SLOPE FAILURE THAT OCCURRED IN WEATHERED ROCK.

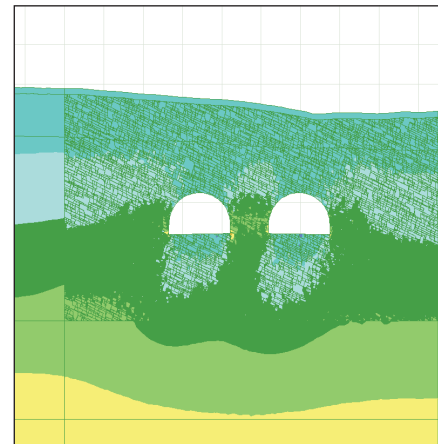


▲ X displacement contours

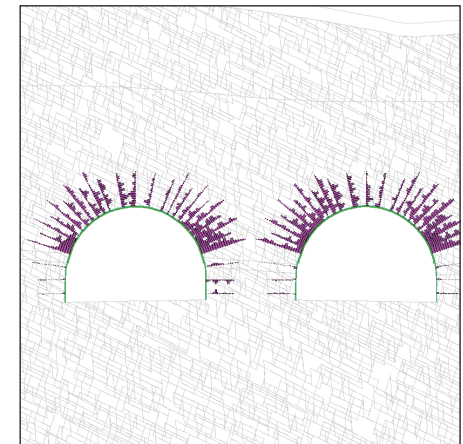


▲ Y displacement contours

ANALYSIS OF GROUND DEFORMATIONS AND GROUND SUPPORT BEHAVIOR ASSOCIATED WITH TWO ROAD TUNNELS



▲ YY Stress Contours



▲ Axial Force on Structure

# FEATURES

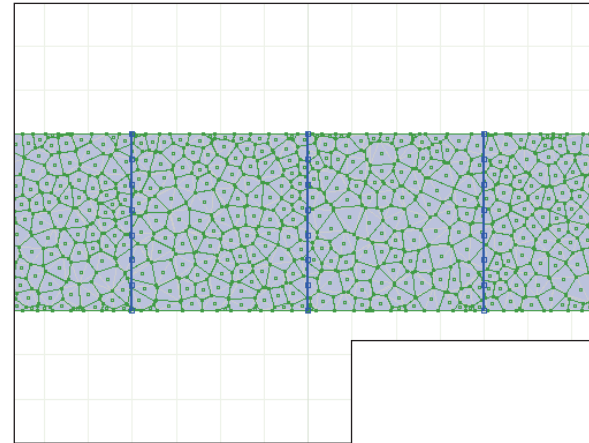
**UDEC FACTS**

UDEC and its 3D counterpart 3DEC have been the subject of three international symposia. There are also more than 776 publications that describe the application of UDEC and 3DEC to problems in the mining, civil, mineral, process, waste isolation, and petroleum engineering industries. A complete bibliography, references for the symposia, and more are available at this location on the Itasca web site: [www.itascacg.com/udec\\_pubs.html](http://www.itascacg.com/udec_pubs.html)

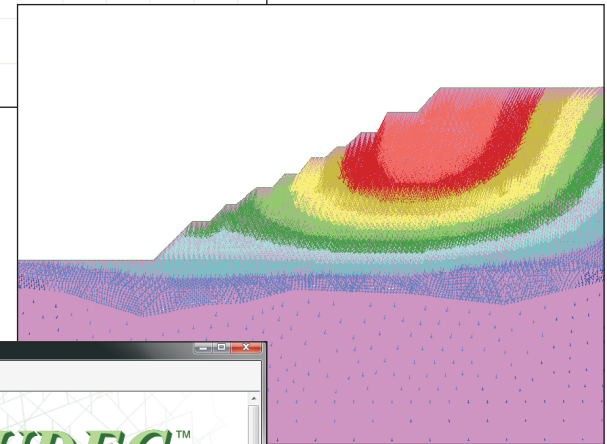
UDEC simulates large displacements — slip and opening — along a discontinuous medium that is treated as an assembly of discrete blocks; discontinuities are treated as boundary conditions between blocks. Models may contain a mix of rigid or deformable blocks. UDEC provides libraries of material models and constitutive models for deformable blocks. Thermal and fluid flow calculation modes are available, and may be coupled to the base mechanical calculation. The program can model excavation, backfill simulation, “infinite domain” problems, dynamic problems (with absorbing boundaries and wave input). Structural elements are available and may be coupled to continuum blocks or to discontinuities. It also provides a built-in scripting language (FISH) to customize or automate virtually all aspects of program operation, including user-defined properties and other variables.

The program can be configured optional modules that extend the capabilities of the base program (see the Options section for more information).

The UDEC user interface provides a complete interactive modeling environment, project management facilities, a built-in library of materials, easy specification of boundary conditions and structural elements, movies, extensive plotting capabilities, and run-time monitoring of results.

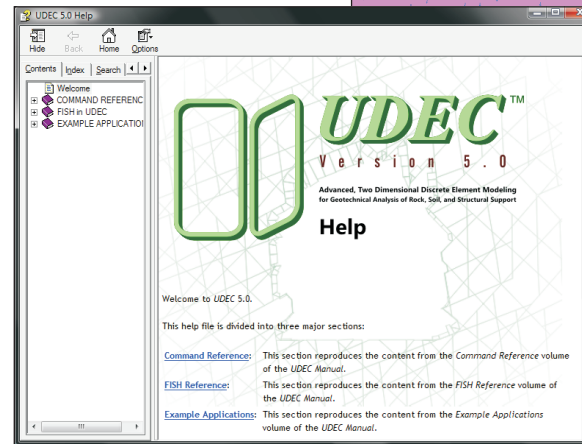


◀ Voronoi blocks generated to simulate a rock bolted beam of loose material.



▲ Contours of displacement magnitude in a tunnel model. The axial forces on the rockbolt elements are also plotted.

▼ UDEC 5.0 compiled help file



## NEW IN 5.0 (cont.)

### UDEC FACTS

Itasca is a global firm dedicated to providing its clients better insight into the behavior of the engineered earth environments where they operate. UDEC is developed by engineers, for engineers, to solve real world engineering problems. We know what those problems are, because we tackle them every day.

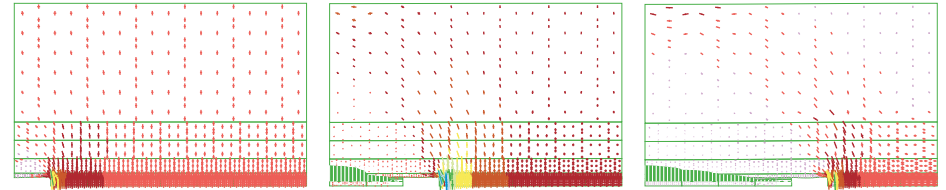
**Automatic Voronoi joint generator:** A new algorithm has been implemented that reduces Voronoi block generation time by a factor of approximately 100. The Voronoi block generation range control has been modified to include any range command that can be used to select blocks.

New and extended plotting capabilities such as all color scaled vector quantity plots make determination of areas of high and low activity more apparent; added joint normal and shear stress plots; joint attribute plots are now displayed with colors scaled to the joint attribute magnitude; new moment-thrust plot for structural liners; new thrust-shear plot for structural liners; new displacement magnitude contour plot; new velocity magnitude contour plot; improved boundary condition plotting to include fluid settings.

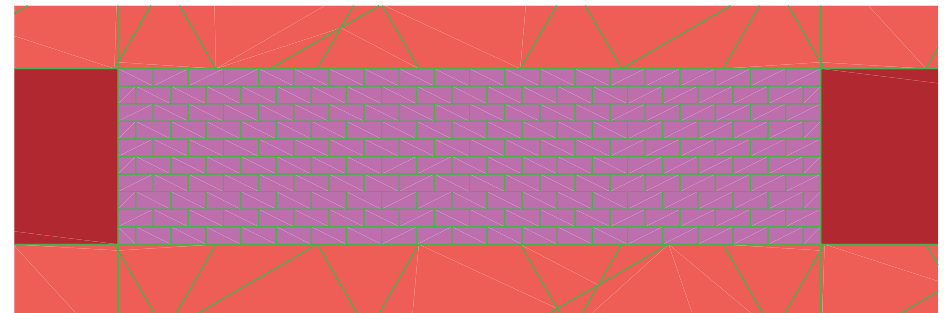
Documentation enhancements include a compiled help (CHM) file that is available inside the GUI that includes all commands from the Command Reference volume (and the FISH User's Guide too) from the UDEC Manual.

Zone and Joint DLL models are automatically loaded, providing greater convenience when restoring save files.

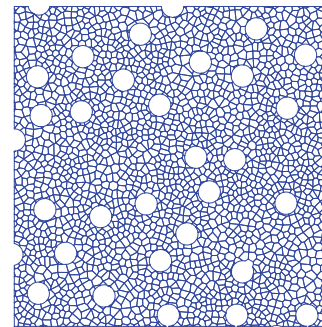
New facility for specification of welded construction joints, and cracks can be specified as construction joints. These cracks are normally used to define excavation boundaries and to provide zone density control. The new feature allows them to be included while minimizing the effect on the model behavior.



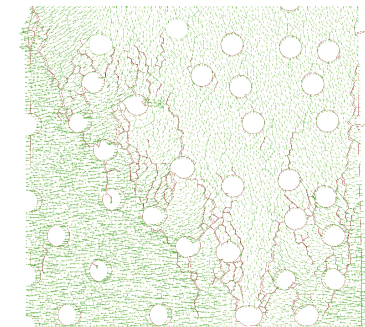
▲ backfilling a deep long-wall excavation; stress states, from left to right: at 10m excavated, at 30m excavated and 20m backfilled, at 50m excavated and 40m backfilled



▲ masonry diaphragm wall in mine entry



▲ model of lithophysal tuff



▲ Damage in model (cracks in red; displacement vectors in green)

# NEW IN 5.0

### UDEC FACTS

UDEC has been available for over 26 years and is used by engineers, consultants, and in university teaching and research. UDEC is currently licensed to more than 1132 users in over 58 countries — making it one of the most widely used two-dimensional numerical modeling tools for geotechnical analysis in the world.

Speed increases up to 30% faster than the previous version (this number can vary; the exact increase is subject to the user's hardware configuration)

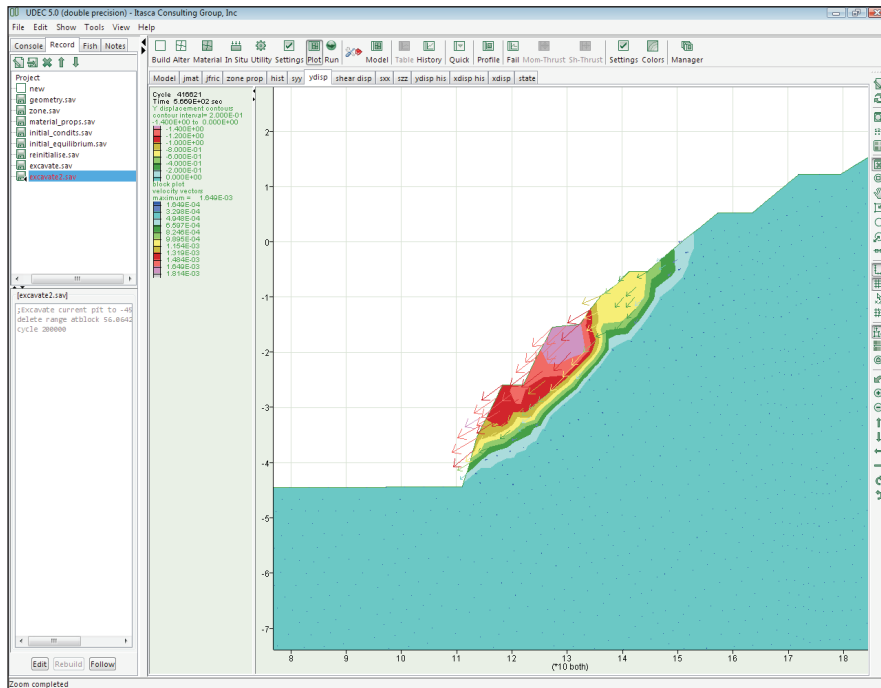
Redesigned user interface is more functional, easier to use, and easier to configure. Range specification and FISH utilization are substantially improved in the interface.

More accurate plasticity solutions using Nodal Mixed Discretization. Zone strains at common nodes are averaged, which leads to a better plasticity solution by reducing the locking effect of lower order elements.

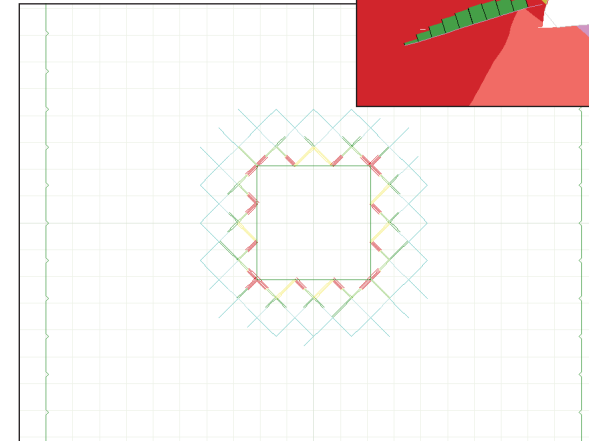
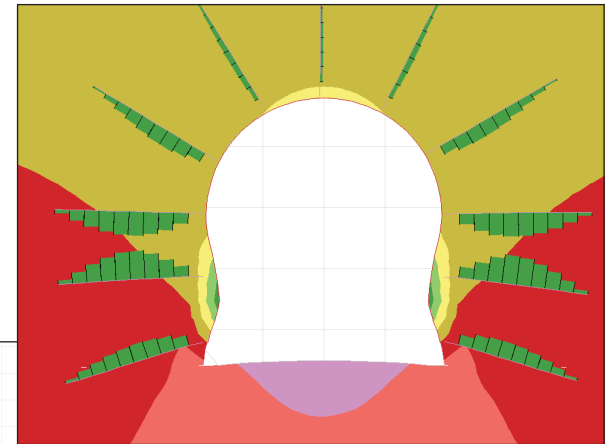
Improvements to structural elements include: greater control provided through improved structural liner commands, New fixed degrees of freedom for structural nodes to allow lines of symmetry to be used with liners, and an entirely new element type — rockbolt — has been added.

The fracture fluid flow logic in UDEC has been expanded to allow the modeling of gas flow. In Gas flow the bulk modulus of a gas is equal to its pressure.

▼ Screen shot of the new UDEC 5.0 GUI.



▼ Contour of gas pressure in joints surrounding a pressurized cavern.



▲ Contours of displacement magnitude in a tunnel model. The axial forces on the rockbolt elements are also plotted.