FLAC$^{3D}$™ VERSION 5.01

Advanced, Three-Dimensional Continuum Modeling for Geotechnical Analysis of Rock, Soil and Structural Support
**FLAC** is a numerical modeling code for advanced geotechnical analysis of soil, rock and structural support in three dimensions.

**FLAC** 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 continuum analysis is necessary.

**FLAC** utilizes an explicit finite-difference formulation that can model complex behaviors not readily suited to FEM codes, such as problems that consist of several stages, large displacements and strains, non-linear material behavior and unstable systems (even cases of yield/failure over large areas, or total collapse).

- Isocontours of displacement around excavated underground tunnels and caverns show little interaction between the openings.
Flow analysis, using an interface, of broken rock pulled from a draw point. Displacements within the fractured rock and along the interface are shown.

Dynamic displacements within an earth dam (shown in section) generated by a seismic input wave.
**FLAC³D 5.01**

**FEATURES**

- Large-strain simulation of continua.
- Interfaces can simulate faults, joints or boundaries.
- Explicit solution scheme can model unstable physical processes.
- Fifteen built-in material models, with the optional ability to add user-defined models.
- Available in 32-bit and 64-bit versions.
- Supplemental modules extend the base program to suit the user’s analysis requirements.
- Deterministic, continuous gradient or statistical distribution of any property.
- Automatic 3D grid generator using pre-defined volumes.
- Easy specification of model boundary and initial conditions.
- Water table for effective stress calculations.
- Find model Factor of Safety.

Two parallel horseshoe tunnels excavated in a number of cuts are shown.
• Groundwater flow fully coupled to mechanical calculation.
• Many structural element types available (bolts, beams, liners and more).
• Built-in scripting language provides powerful user-control over every aspect of the program.
• Export graphics in a range of formats.
• Graphical interface provides intuitive controls for setting up plots and charts for analyzing and post processing operations.
• All program options are easily available through a single user dialog.
• Built-in text editor provides command syntax error checking.
• Interactive mouse provides point-and-click manipulation of model views.

Open pit model showing two major intersecting faults modeled using interfaces. Shear slip is being plotted along the interfaces.
**FLAC**<sup>3D</sup> **FACTS**

**FLAC**<sup>3D</sup>, in addition to the extensive documentation that appears in the manual provided with the program and available as PDFs, is supported through Itasca’s web site in a number of ways, including:

- Free program updates;
- Command line and interactive help;
- Demonstration versions;
- Movies illustrating code; and
- New features and known issue alerts with the code, and more.

Visit the section of the web site: [www.itascacg.com/flac3d](http://www.itascacg.com/flac3d)

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**NEW IN 5.01**

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**Improved Performance**
- 15% faster overall.
- Structural element calculations are 30x faster, or more.

**User Interface Additions**
- Command-level UNDO: A complete record of all commands used to create a model is recorded in the model save file.
- Complex CAD data can be imported into the model and used for visualization or filtering of objects.
- Improved Group logic allows you to flexible and efficient assignment of one or more names to objects for reference.
- Additional methods of filtering objects: If connected to interfaces, if on model surface, filter by object extent instead of centroid, etc.

**New Grid Generation Tools**
- Interactive 2D Extruder for generating 3D meshes.
- Densify zones for increased discretization in target areas, including the creation of oct-tree meshes.
- Generate topology command provides for the creation of zones between existing surface faces and a surface topology as well as for complex, non-intersecting layer geology.

**Even Better Plotting**
- Improved quality of printed output: 2D data is drawn at maximum printer resolution.
- Additional Plot Export options: Postscript, VRML, SVG and Excel formats. VRML plots can be used to create 3D PDFs.
- Improved plot view controls.
- Profile data in an arbitrary line and visualized either as an XY-chart or as a color contoured line in space.
- Full Unicode text support.
- Underground work bay (transparent) supported with shotcrete and rock bolt structural elements.

- Interactive 2D extruder for creating 3D meshes; it can also import *FLAC* meshes.
Itasca is a global firm dedicated to providing its clients better insight into the behavior of the engineered earth environments where they operate. FLAC® is developed by engineers, for engineers, to solve real world engineering problems. We know what those problems are, because we tackle them every day.

**Enhanced FISH**
- Many improvements to FISH, Itasca’s built-in scripting language (see Figure to right).
- FISH access to the ATTACH logic.

**Other New Tools Include**
- Generate, or import, Discrete Fracture Networks (DFN) and assign zone properties based on them. Visualization of calculated data (stresses, displacements, etc.) and the selection and filtering of zones can be done using the DFN.
- New energy calculation allows you to track elastic strain energy and dissipated plastic energy.
- The Modified Hoek-Brown constitutive model that is now compatible with factor of safety calculations.
- Pack/Unpack option to share or archive an entire project.
- Updated electronic (PDF) manuals.
- Easier creation of Constitutive Models and FISH intrinsic plug-ins as project templates can now be installed into Microsoft Visual Studio.

Model zones (outlined) that are associated with a DFN (brown disks).
New FISH features include (1) local and global variables, (2) command [in-line FISH], (3) simpler item looping, (4) new FISH intrinsics, (5) passing data into and from FISH functions, and many others.

View down an extraction drift with total stress contoured along the tunnel walls.

It is now easy to created a model from a topographical grid using a single command.
3D FLAC Optional Modules

Options in FLAC 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 FLAC include:

- Dynamic;
- Thermal;
- Creep; and
- C++ Plugins, including Constitutive Models.

These options provide rich, extensive additions to the base software. For more information, visit: www.itascacg.com/flac3d/options.php

Concrete wall model consisting of a wall of new concrete footed on a base plate of old concrete. The thermal hydration model and the modified Drucker-Prager model with hydration are prescribed for the concrete wall. The base plate is elastic and thermally isotropic.
Optional Modules

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KUBRIX® Geo Mesh Generator

Users who anticipate the need to produce models requiring elaborate and complex 3D geometries are advised to consider KUBRIX Geo, a separate software tool that can seamlessly generate 3D grids ready for import into FLAC3D and other Itasca codes. KUBRIX Geo is a unique automatic grid generator (hexahedral, tetrahedral, octree and hybrid models) built for the demanding geometrical requirements of petroleum and mining geomechanics (non-manifold surfaces, hundreds of materials, hundreds of intersecting intermittent faults). For more information, visit: www.itascacg.com/kubrixgeo/index.php

FLAC3D models meshed from DXF data using KUBRIX Geo to create a: (1) normal mesh; (2) tetrahedral mesh; (3) oct-tree mesh; and (4) hexahedral mesh representing simulated site geology, colored by material.

A hybrid mesh with tetrahedral zones embedded within an oct-tree mesh, which conform to potential slip surfaces (faults or joints) defined by interfaces.
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**SUMMARY**

**Suggested System Minimums**
- Windows XP, Windows Vista, Windows 7, Windows 8; 150 MB free space on hard drive;
- 2 GB RAM; Graphics card with OpenGL 1.1 or higher; 1GHz or better processor.

**Standard License Includes**
- FLAC\(^3\text{D}\) Version 5.01 installation CD;

**Support**
- Free: code updates and support information via web site; free direct support for code installation and general code operation.
- Fee-based: Engineering consulting and model generation support is available.

**Sales**
- Varies with Location: Locations of Itasca offices and agents throughout the world, including a locator to determine the user’s FLAC\(^3\text{D}\) sales office/agent, are available from the Itasca web site: [www.itascacg.com/software/sales.php](http://www.itascacg.com/software/sales.php).

**Supplemental Software Available**
- Creep, Dynamic, Thermal, User-Defined Constitutive Models, KUBRIX® Geo.
- *These options are included at an additional cost.

For more information, visit our site:
- [www.itascacg.com](http://www.itascacg.com)
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