MassFlow™ Version 9.0

Analysis of Material Flow to Drawpoints

SOLVE YOUR MOST COMPLEX GEOMECHANICAL PROBLEMS

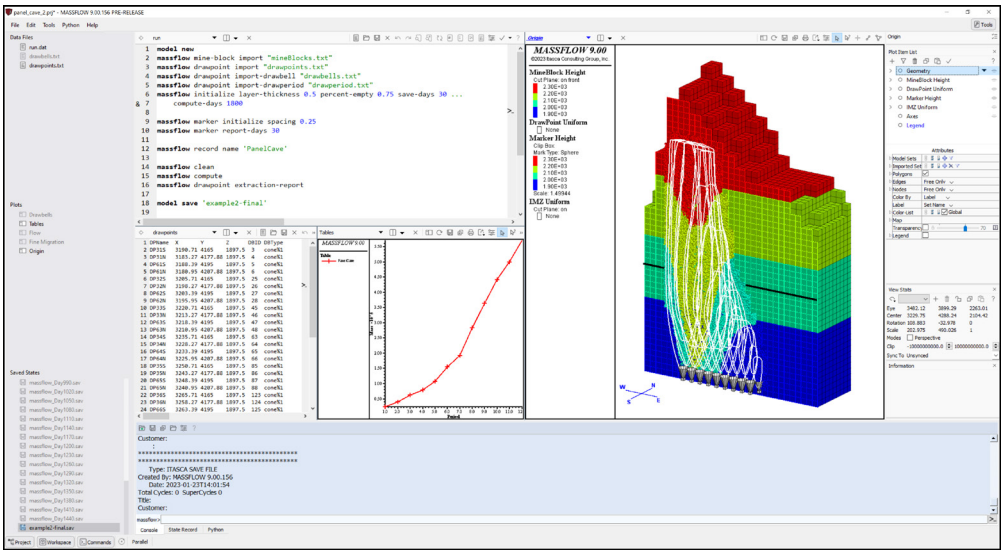
MassFlow is the best solution to solve complex geomechanical problems for three-dimensional analyses of gravity flow for block, panel, and sub-level cave mine and stoping mine modeling. MassFlow simulates material draw down by simulating the growth of draw zones and corresponding fragmented rock flow associated with each mine drawpoint. Use MassFlow to optimize drawpoint layouts and predict air gaps, and to estimate recovery and dilution, fragmentation, and fines migration. MassFlow may be run independently or coupled with 3DEC or FLAC3D to consider the influence of stress and rock yielding. Flexible commands and scripting allow for model parameterization, flexibility, customization, and automation. With MassFlow, the only modeling limitation is your imagination.

HOW IT WORKS

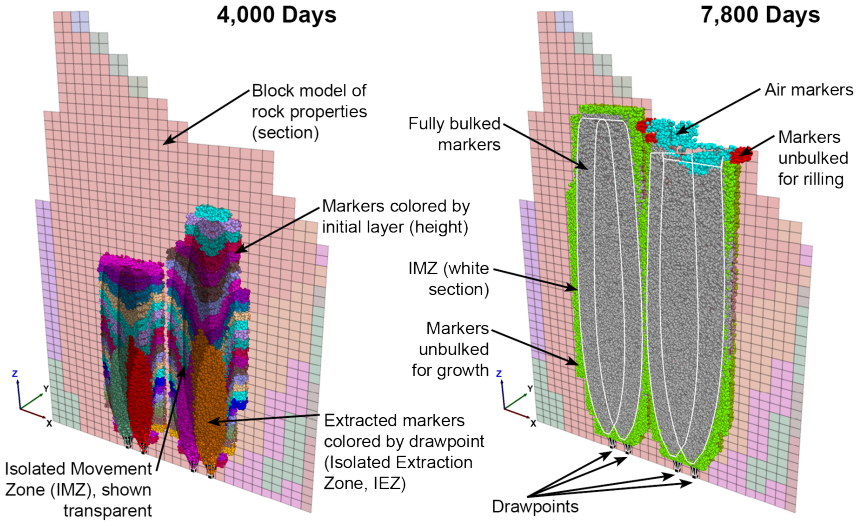
MassFlow simulates material flow by tracking the growth of isolated movement zones (IMZ) and the internal material movement associated with draw. All inputs are provided from four CSV files to define properties, drawpoints, and schedule.

Block model properties control IMZ growth and other mechanisms. IMZs are discretized into layered disks and encompass moved material. Markers are used to track internal movement. The initial positions of extracted markers define the isolated extraction zone (IEZ). MassFlow enforces a local rilling angle at free surfaces. The development of air gaps is tracked in MassFlow through the addition of zero mass "air" markers at any location where an IMZ meets a fixed boundary to flow.

Couple[1] MassFlow to 3DEC or FLAC3D to consider the influence of stress, simulate caving processes, and estimate the yielded zone and cave back due to mining. The IMASS constitutive model is ideal for such simulations. For each extraction period, MassFlow informs 3DEC or FLAC3D of the location of the IMZ and the presence of air, if any. 3DEC or FLAC3D then computes stresses associated with the presence of these zones and estimates the yielded zones surrounding the cave. They then inform MassFlow which initially inactive zones can now be mobilized (unbulked for growth). This process repeats until the draw schedule specified is complete.



MassFlow model of a panel cave beneath an open pit mine showing marker movements after five years of mining across 38 drawpoints. IMZs are shown in section (white outlines) with the ore/waste demarcation shown as a line.



Anatomy of a MassFlow model showing the IMZ, IEZ, movement layers, and marker types with the block model showing lithology in section for 4,000 and 7,800 simulated days of cave mining from four drawpoints. The right- most draw point extraction rate was doubled after 480 days of mining.

ITASCA Software

ItascaSoftware.com/MASSFLOW

EASE-OF-USE

- Simply driven by four input data files:
  - Mine block model of rock properties
  - Drawpoint locations
  - Draw bell descriptions (conical and rectangular)
- Draw periods/schedule
- Use a Wizard to import the input CSV files and specify model settings. It will automatically generate the simulation datafile commands to run uncoupled flow models.
- Itasca's Version 9 software makes it easy to tile plots, data files, and tool panes.

ANALYSES

- Solve for any discrete increment of time or for the entirety of the draw schedule
- Drawpoint layout design
- Caveability and caving rate
- Air gap formation
- IMZ and IEZ limits
- Movement of caved material in the IMZ
- Marker path tracing (displacement/day or extraction status)
- Marker velocity vectors
- Tonnage, ore recovery, and dilution entry
- Primary and secondary fragmentation
- Fines migration
- Breakthrough timing and subsidence
- Incorporate previously mined regions
- Abutment stresses and cave loads[1]

FLEXIBLE

- Highly customizable user interface (UI) and modeling
- All licenses permit two instances of MassFlow to be run simultaneously on the same computer
- Access and modify almost all variables (including "EXTRA" variables) via FISH
- Import and export any ASCII data format

POWERFUL

- Now runs 1.7x faster than earlier versions through code architecture and multi-threading improvements
- Optimized marker search and sorting algorithms
- For efficient modeling, markers are only created once the rock mass becomes unbulked
- Multi-threaded FISH Lists and Operators to query or modify the model incredibly quickly, even while cycling
- Advanced plotting tools to understand your model results and for working with hundreds of plots on real projects
- FISH, Itasca's scripting language, provides unparalleled control and customization of the model
- Built-in Python 3.10 scripting[2] includes SciPy for plotting, NumPy for computing, and Pyside for UI customization
- Most model changes (via mouse, commands, or scripting) are recorded for repeatability, learning, and re-use

LICENSES

- **TERM:** Annual renewal (paid monthly or annually)
- **TYPE:** Web license
- Use web licenses with one or more seats across organizations
- Academic licenses are available
- Without a license, the software may be run in demonstration mode (some modeling restrictions apply)
- Short-term trial licenses are available upon request

ONLINE RESOURCES

Demonstration Software
www.itascacg.com/demos

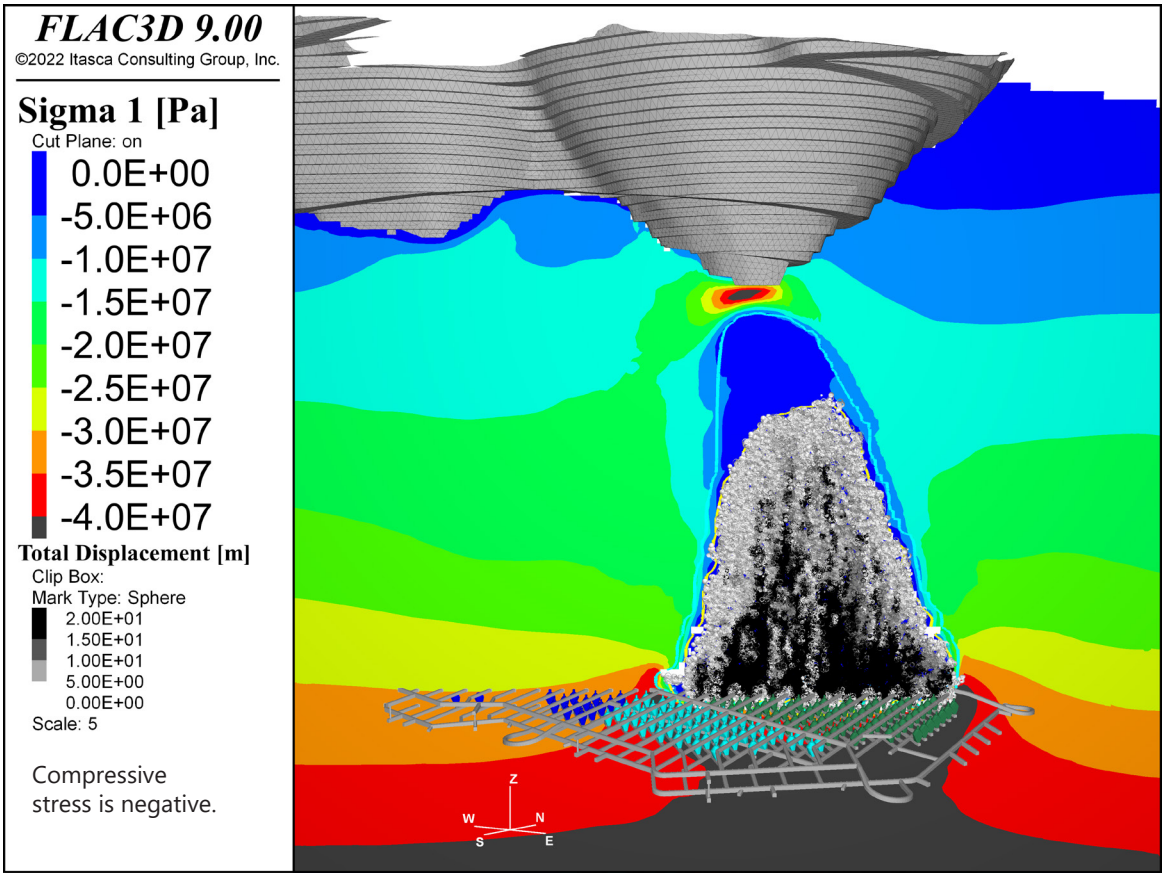
Itasca's Software Documentation
docs.itascacg.com

Itasca's Software Forum
forum.itascainternational.com

Itasca Software Academy
academy.itascainternational.com

Technical Support
www.itascacg.com/help

Purchase Software
https://itascasoftware.com/massflow



MassFlow can be coupled[1] to 3DEC or FLAC3D for a hybrid model to consider the influence of stress, simulate the caving process, and determine the yielded zone and cave back associated with the material drawn.

[1]To couple MassFlow models, a valid FLAC3D or 3DEC license is required.
[2]The general Python module is included, but it is not currently connected to MassFlow variables.