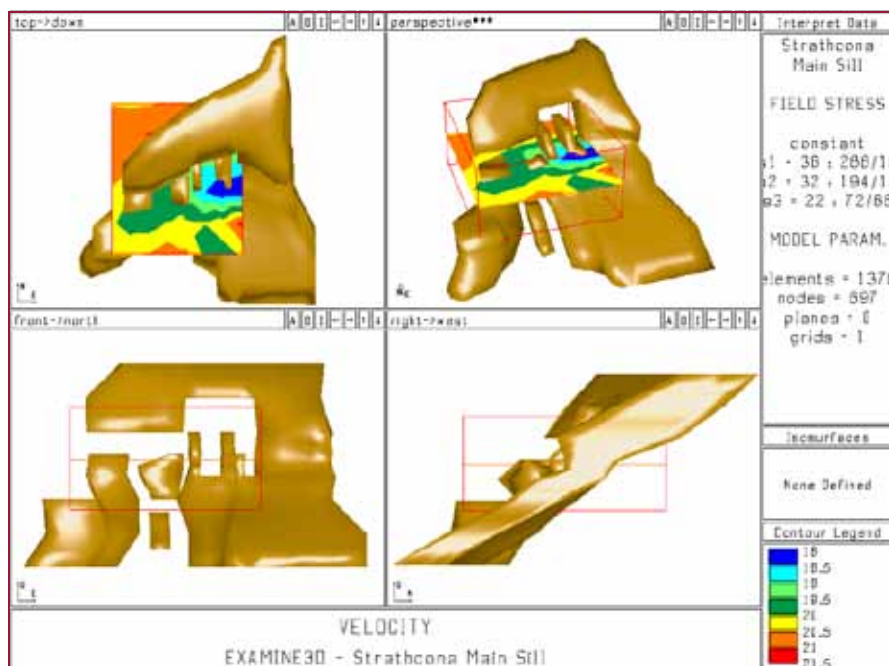


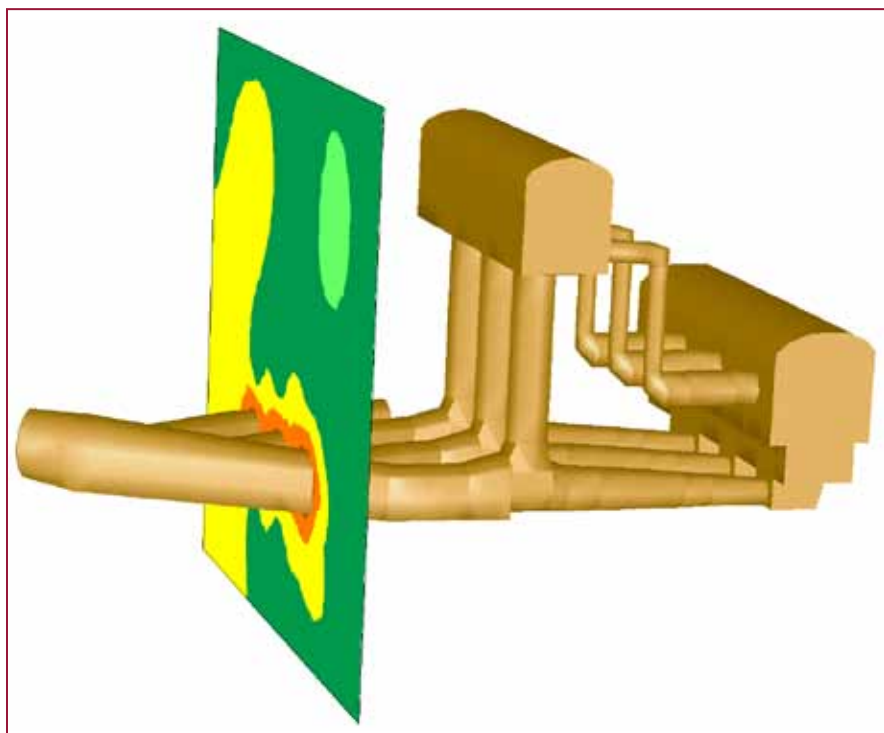
# Examine<sup>3D</sup> 4.0

## 3D Stress Analysis for Underground Excavations

*Examine3D is an engineering analysis program for underground excavations in rock. Although developed mainly for stress analysis, its data visualization tools can be applied to a wide range of three-dimensional mining and civil engineering data.*



Large underground mine, showing seismic velocity contours on a horizontal cutting plane.



Powerhouse caverns for hydroelectric project. Strength factor contours on a vertical cutting plane.

### Model

*Examine<sup>3D</sup>* consists of three program modules: Model, Compute and Interpret. **Model** is used to create the excavation geometry and boundary element mesh, and define material properties and loading conditions. Model geometry can be imported from AutoCAD or created in *Examine<sup>3D</sup>* using powerful CAD-based drawing and editing tools. Advanced mesh generation options simplify the task of generating a high quality mesh. The mesh is automatically checked for validity, to ensure that there are no gaps in the mesh and that elements do not intersect or overlap.

### Compute

*Examine<sup>3D</sup>* uses the direct boundary element method to **Compute** the 3-dimensional elastic stress state around underground excavations. Stress, displacement and strength factor are computed at user-defined locations, including planes, volumetric grids, points, or on the excavation surface. The compute engine is optimized for speed and accuracy.

### Interpret

The **Interpret** module of *Examine<sup>3D</sup>* is used to visualize analysis results. Contouring, isosurface generation, stress flow ribbons and trajectories can be viewed. Advanced shading, transparency and animation algorithms provide state of the art graphical output. In addition to stress analysis, *Examine<sup>3D</sup>* can be used for a variety of other data visualization purposes. For example, *Examine<sup>3D</sup>* can be used to visualize micro-seismic datasets such as seismic velocity, source parameters, and event density.

## 3D Stress Analysis for Underground Excavations

### Modeling

- graphical data entry / editing
- B-REP – geometry construction using skinning, extrusions, facing
- Autocad DXF import / export
- automatic meshing / re-meshing techniques
- volume and surface area calculation
- automatic geometry validation
- distance measuring
- pressure boundary conditions
- geometry slicer

### Elements

- constant, linear, or quadratic element formulations
- closed-form integration close to boundary
- conforming elements
- virtual number of elements
- free surfaces

### Far Field Stress

- constant
- gravitational

### Strength Criteria

- Hoek-Brown
- Mohr-Coulomb

### Compute

- direct boundary element method
- optimized for speed and accuracy
- restart capabilities

### Stress / Displacement Calculation

- on cutting planes
- within volumetric grids
- at user specified points
- on surface of excavation

### Data Interpretation

- isosurface generation
- stress trajectories
- stress flow ribbons
- stress / displacement / strength contours
- ubiquitous joints
- advanced rendering capabilities –
  - Gouraud / Phong shading

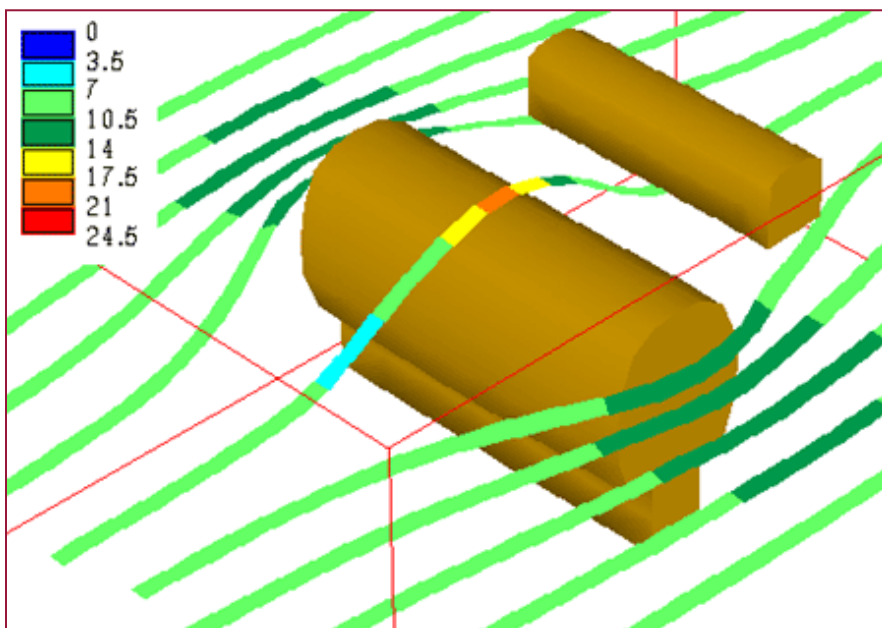
- texture mapping
- smooth animation
- transparency
- display seismic / general data
- show stresses on surface of excavation
- differential stress between stages
- plot any function of stress, displacement
- scattered data interpretation

### Exporting Results

- GIF, PCX, TGA image files
- postscript printer support
- export to *Examine<sup>2D</sup>* / *Phase<sup>2</sup>*

### Utilities

- DxfGeo
- DStress
- Energy balance
- Eden
- AvgTen
- Convert to PTS
- Sphere
- Restart



Stress flow ribbons around underground power caverns.

### Price & Licensing

*Examine<sup>3D</sup>* 4.0 is sold as single licenses, which are purchased outright, for \$1795 US (\$1795 CDN).

Network licenses are also available; they are sold as a yearly subscription, with price based on the number of concurrent users. Please contact [software@rocscience.com](mailto:software@rocscience.com) for more information.

[www.rocscience.com](http://www.rocscience.com)