



## **FracMan® geotechnical edition software**

FracMan allows you to model the rock mass fracture system explicitly by building three-dimensional (3D) networks of both deterministically mapped larger structures and stochastically generated smaller fractures. Calibrate your models against borehole information, underground scan lines, drift mapping, outcrops and bench mapping to ensure a good match between field data and the model. Once developed, these models can be used for critical rock mechanics analyses. FracMan gives you the flexibility to build discrete fracture network (DFN) models ranging from simple volumes for data exploration, local-scale analysis or Synthetic Rock Mass (SRM) testing, all the way to complex mine-scale models.

### **FRACMAN DFN WORKFLOWS**

The key to success with fractured rock mass characterization is data integration – geological, geomechanical, geophysical and petrophysical, plus well test and other hydrogeological data.

FracMan helps you characterize the fracture network through a three-stage approach:

#### **Fracture quantification**

FracMan has a range of tools that allow you to quantify the properties of your fracture network, including distribution, orientation, size and intensity of fractures.

#### **Model generation**

FracMan generates geologically realistic DFN based upon a range of properties, including geostatistical or structural modeling, mechanical layering, curvature analysis, strain fields conditioning and outcrop.

#### **Validation of the model**

Test your model by simulating borehole drilling and trace mapping to compare the actual and modeled fracture properties.

### **DFN APPLICATIONS IN GEOTECHNICAL ENGINEERING**

#### **Excavation design**

Use FracMan's kinematic engine to identify and assess the stability of probable rock wedges in slopes, tunnels and shafts without the highly conservative assumptions of conventional kinematic analysis. Run Monte Carlo simulations to quantify the probability of adverse wedge formation and optimize support requirements.



## Fragmentation assessment

FracMan allows the mapping of in situ block size and shape for fragmentation assessment. Integrate these models with numerical codes to determine primary and secondary fragmentation evolution during block and panel caving. Evaluate the effectiveness of pre-conditioning strategies on fragmentation distribution in caving operations.

## Engineering optimization

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## Input to numerical models

Integrate DFN models with advanced numerical codes such as Elfen, 3DEC®, Flac3D® and Abacus® for synthetic rock mass testing and advanced rock breakage simulations.

## Mineral resource evaluation

Use FracMan's modeling power to estimate the volume of mineralization within vein-hosted deposits. Determine likely dilution through hanging wall instability following ore removal.

## Hydrogeological investigations

WSP's flow code simulates steady state and transient flow through your fracture network model. Understand groundwater heads in pit slopes; predict fracture inflows into tunnels; and derive accurate, upscaled, equivalent cellular permeabilities.

## KEY FEATURES

Analyze televiewer logs, oriented core, bench and face mapping, and photogrammetric surveys to derive fracture orientation properties, fracture size and intensity.

- Interpret fracture intensity logs from boreholes to derive 3D fracture intensity patterns. Generate geologically realistic fracture networks based on structural, geomechanical and geological principles
- Calculate surface curvature from interpreted horizons for guiding fracture generation
- Sample the DFN model with simulated boreholes, pit slopes, tunnels, stopes and shafts to determine fractures that are intersecting these samples
- Generate multiple stochastic realizations for uncertainty management through automatic Monte Carlo simulation and analysis
- Convert the DFN model into equivalent grid properties, including fracture rock mass properties and directional stiffness
- Provide constrained fracture input into numerical simulations such as Elfen®, UDEC® or FLAC®
- Utilize easy to use macro language to automate virtually all tasks including data analysis, model building, grid operations, visualization and exporting
- Conditioning of the DFN model to borehole, tunnel, rock slopes and face observations, including rock mechanics and hydraulic properties

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## ABOUT WSP

As one of the world's leading professional services firms, WSP exists to future-proof our cities and environment. We provide strategic advisory, engineering, and design services to clients in the transportation, infrastructure, environment, building, power, energy, water, mining and resources sectors. Our 55,000 trusted professionals are united by the common purpose of creating positive, long-lasting impacts on the communities we serve through a culture of innovation, integrity and inclusion. Sustainability and science permeate our work. To find out more, visit [wsp.com](http://wsp.com).



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