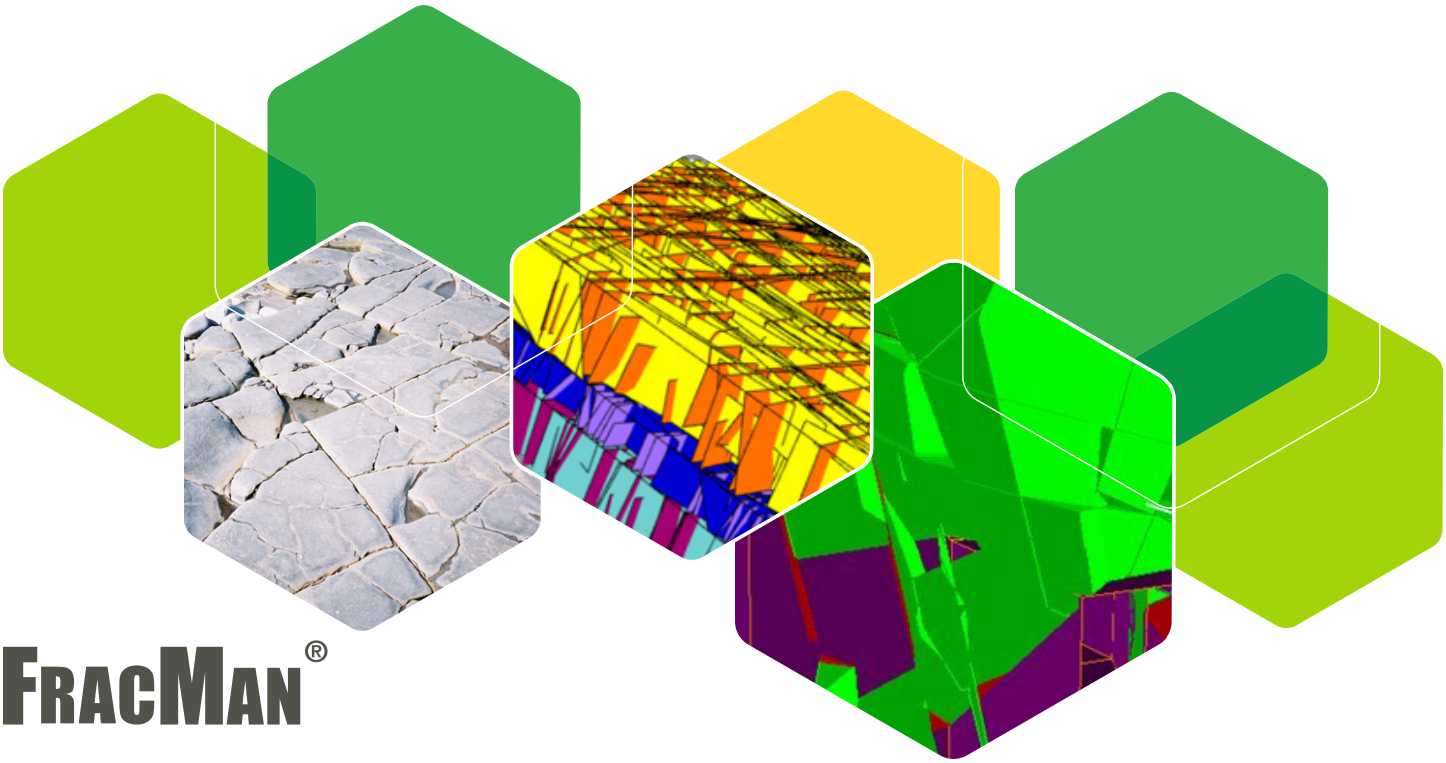


FRACMAN®

Geomechanics Edition

The Leading Discrete Fracture Network Analysis Tool

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 characterisation 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 the 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 modelled fracture properties.

DFN APPLICATIONS IN MINING & 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 optimise 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 Optimisation

Use FracMan® to optimise borehole and drift orientation with respect to the fracture network to improve the efficiency of drainage systems, probe hole investigations or grouting systems.

Input to Numerical Models

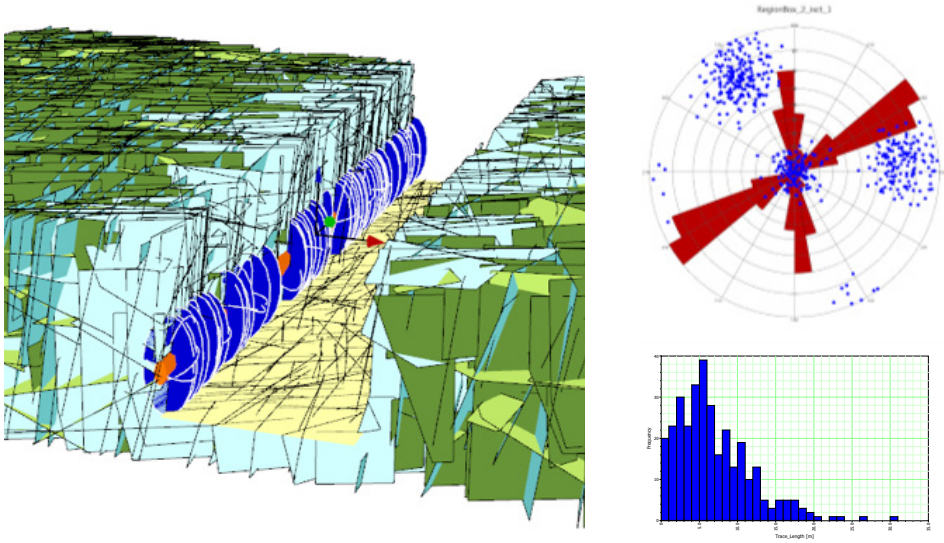
Integrate DFN models with advanced numerical codes such as Elfen®, Flac3D® or PFC® for synthetic rock mass testing and advanced rock breakage simulations.

Mineral Resource Evaluation

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

Hydrogeological Investigations

Golder's Mafic 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.



DFN Model of a Road Cut with Examples of Source Input Data

KEY FEATURES

- Analyse 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 realisations 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 task including data analysis, model building, grid operations, visualisation and exporting
- Conditioning of the DFN model to borehole, tunnel, rock slopes & face observations, including rock mechanics and hydraulic properties

Contact us at: fracman@golder.com

Golder has FracMan expertise in the UK, USA, Canada and Sweden.