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DISCRETE FRACTURE NETWORK (DFN) MODELING AND SYNTHETIC ROCK MODELING FOR MINE CAVING ASSESSMENT — PALABORA

Purpose(s): preliminary study on discrete fracture network (DFN) modeling for further Synthetic Rock Mass (SRM) modeling and undercutting and caving assessment.

Client: SMI (Sustainable Mineral Institute) University of Queensland, Brisbane Australia

Date: 2006

Location: Palabora (South Africa)

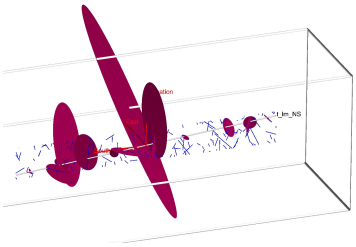
Partners: Itasca Consulting Group

Project executive manager: Caroline DARCEL

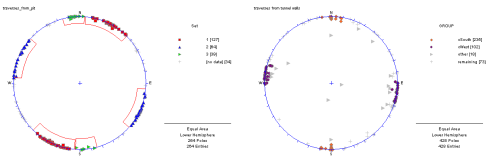
Software(s) used: *3FLO*, (*DIPS* 5.0, Origin 7.1), *PFC3D*

As part of the MMT (Mass Mining Technology) project, Itasca was put in charge of the modeling aspect of **DFN**. In short, the MMT project tests the validity of **using Synthetic Rock Mass (SRM) samples as a means to predict how a given rock mass will respond to undercutting and caving**. Tri-dimensional (3D) SRM samples simulating the rock mass are modeled with *PFC3D* as cubes, 10 meters in edge size, embedded with a **discrete network of disc-shaped flaws** (joints).

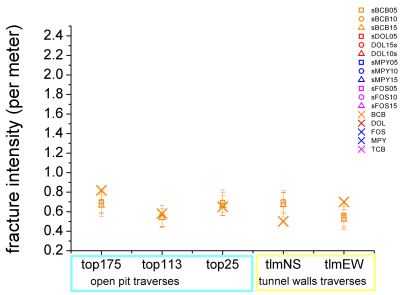
The purpose of DFN simulation is to **generate explicit representations of the network of open joints present in the lithologies of the Palabora Mine**. Data were derived from various open-pit and underground line-mapping data, with varying levels of quality.



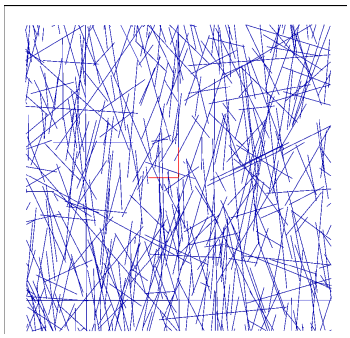
Sampling process illustration: scanline along a tunnel wall.



Traverse orientations from open pit (264 elements); traverse orientations from underground (428 elements).



Fracture frequencies measured and simulated on the 5 main traverse orientations, carbonatite unit (BCB)



10-0m x100-m N-S trace map of DFN produced for BCB.

KEYWORDS:
- Discrete Fracture Network
- Joints
- Scaling Model
- Borehole, Fracture trace map
- Stereological analysis
- SRM (Synthetic Rock Mass)
- Mine, Caving, undercutting

⇨ RESULTS:

- 700 sampling traverses distributed throughout the open pit and the underground are analyzed. Most traverses are horizontal and eventually are assembled into 5 main groups.
- Calibration is performed for one traverse, and intensity measurement consistency is checked on others.
- For a given lithology, underground and open-pit data may be different; data are combined to produce a mean DFN.
- Joint orientations are mostly close to vertical. Most fracture traces exceed 15 m in length. Significant assumptions are necessary on fracture sizes. Finally, the power law model for length with an exponent of – 4 and a cut-off set to 15 is chosen. One DFN is defined for each lithology, with bootstrapped orientations.

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