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Numerical Modeling in Safe and Cost-effective Mine Design, Stability Assessment and Support Dimensioning

Numerical modeling is a powerful tool which plays an important role in the approach to engineering design in order to conceptualize a design, quantify risk and verify design parameters while executing a design. Before costly and often, risky experimental mining is done, the available mining alternatives can be evaluated and compared in a cost-effective manner.

Numerical models are routinely used for mine design and feasibility studies, for assessment of failure mechanisms, and for estimation of geotechnical risk.

Numerical modeling is applied in all stages (phases) of a mine project:

- pre-planning phase;
- detailed mine planning and layout;
- production phase, including dimensioning back analysis;
- closure and ground control afterwards.

The model is calibrated by simulating the mining sequence and comparing the model output to the database observations and instrumentation. Typically, this calibration is not highly detailed in nature - i.e., exact comparisons of deformations are not necessary. However, the model should have the ability to reproduce the general failure mechanisms observed and be able to discriminate between regions that show intensive yield, as well as those that do not.

In addition to the more general mine layout very specific aspects, like the detailed design can also be performed on the basis of numerical models. These structural elements include rock bolts, dowels, cables, wooden, steel or hydraulic props, concrete lining, mesh, masonry support etc. Modeling of support measures allows fulfilling the following tasks:

- comparative consideration of alternative measures;
- dimensioning of measure (material, geometry, type, interaction with rock mass etc.);
- development of economic and safe schemes (distance and type of individual measures);
- development of new types of measures (computer-based design);
- determination of optimum point in time for installation.

So, sophisticated models, which include time-depending constitutive laws and non-linear material behavior, allow assessing all quantities as a function of time.