Borehole plan optimization in rock masses using geostatistical simulation

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ABSTRACT – The economical and safety aspects related with geotechnical engineering, in detail with prospecting works, are significant and increasingly complex. Therefore, optimizing costs that simultaneously guarantee the quantity and quality of information to characterize the rock mass are, nowadays, one of the most important factors in underground works.

The borehole plans, normally defined using the knowhow of a professional, imply large costs in the geotechnical industry, thus this paper presents a new methodology allowing the optimization of such plans. This methodology allies geostatistical techniques (turning bands simulation to model rock mass properties like the Rock Mass Rating or RMR) with a stochastic global optimization algorithm, Simulated Annealing (SA). It relies on sparse information about RMR and randomly generates new points that intend to represent possible locations for additional boreholes. Furthermore, SA is adapted to perform the optimization of a set of points with different depth coordinates in order to represent the reality of the mechanical boreholes, where the information is obtained along the hole. Considering the number of additional boreholes to drill, SA finds a global solution minimizing an objective function, which aims at quantifying the uncertainty on RMR at locations without information.

An application to a gold mine deposit located in Chile is finally presented in order to illustrate and validate the methodology.

Keywords – Borehole plan optimization, Rock mass rating, Geostatistical simulation, Simulated Annealing

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