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3D Estimation of Variables with Complexity in Cross-Correlation Structures

N. Madani[1]

1. Assistant professor, School of Mining and Geosciences, Nazarbayev University, Astana, 01000, Kazakhstan.

ABSTRACT

Linear interpolation of geo-related variables is important in different aspects of mining engineering such as long and short-term mine planning. The ore deposit description obtained from spatial modeling of blast hole datasets have been widely taken into account for short-term mine design and grade control, so as to define the ultimate destination of a mined block. However, complexity in the co-spatial behavior of the grades in multi-element deposits motivates one to employ enhanced geostatistical techniques. Traditional approaches of this purpose such as polygon, inverse distance weighted and even (co)-kriging fashions, are inadequate to reproduce those complexities such as non-linearity, heteroscedasticity and geological constraint that exist among the variables of interest. Employment of such the approaches leads to a significant bias in generated block model and consequently decreases the level of confidentiality in selection of a proper destination, directly impact on annual revenue of a mining project. In this paper, it is of interest to utilize a one of the factor-based approaches to populate the six cross-correlated variables (Fe, Ni, MgO, SiO2, Al2O3 and Cr) by co-kriging in a Nickel-Laterite deposit, for which whole the abovementioned complexities are intrinsically, exist in the samples obtained from blast hole campaign. Comparing the results obtained from the new kriged blocks with traditional approaches of co-kriging showed that the former outperforms the latter in terms of reproducing the complexity in cross-correlation measure, while the shape of correlation can also be dramatically preserved.