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Comparison of kriging neighbourhood analysis (KNA) results from two different software packages: a case study

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Abstract

The quality and outcome of any kriging estimation and conditional simulation exercises are dependent on the definition of the kriging neighbourhood parameters that are applied in these processes. It is necessary to minimise the conditional bias that arises from the application of the kriging estimation methodology. This minimisation can be addressed by a kriging neighbourhood analysis (KNA), whereby the optimum kriging neighbourhood parameters are identified prior to executing the actual block kriging estimation.

Conditional bias presents itself in the reality that the real mining blocks grade averages are more variable than the estimated block grades, which is a consequence of the smoothing effect of kriging. The motivation for this research into the KNA outcomes using different software stems from recognising the importance of minimising conditional bias in the application of kriging in resource estimation. Whilst studies on the comparison of software packages have been done in the fields of computer science, bio-technology, geology, and other areas, no evidence was found in the literature review for a comparison of KNA results being carried out using different software packages. This research was embarked on to establish whether the KNA procedures proposed by different software providers would result in the same kriging neighbourhood parameters being selected for the kriging estimation process.

To do the research from a practical aspect, a case study on Rossing Uranium Mine was considered. The results from the KNA using SUPERVISOR geostatistical software and those from using SURPAC geology and mine planning software is compared in this research. The conditional bias measures that need to be optimised are: the slope of regression; kriging efficiency, and the number of negative weights. This is done by analysing the impact of varying the following parameters in the kriging neighbourhood, namely the estimation block size, the minimum and maximum number of samples to be considered, the search range and the configuration of the discretisation points of the

block to be estimated; which all have an influence on the afore mentioned conditional bias measures.

The same input data, geological model and block configuration, semi-variogram parameters as well as test locations were used to ensure that the outcomes of the application of the software packages would be comparable, valid and not user introduced. The two block configurations tested are for well-informed blocks and for poorly- informed blocks.

This research study concluded that there is no significant difference between the KNA results produced by SUPERVISOR and SURPAC; the two software packages considered, there are however other differences between the software packages which are not related to KNA. For well-informed blocks the optimised conditional bias measures identified using SUPERVISOR and SURPAC are the same with slight differences in the conditional bias measures for poorly-informed blocks. Differences identified are related to the manner in which the individual Software packages select specific samples for inclusion in the kriging neighbourhood.