Updating Mining Reserves with Uncertainty Data

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ABSTRACT:

In mining operations, the time delay between grade estimations and decision about the scheduling of stopes mining can result in seriously outdated information and, consequently, a substantial mined reserves bias. To mitigate this gap between the grade estimation of an orebody and its exploitation, this paper proposes a new method of speedily updating resources and reserves integrated into the concept of real-time mining. This consists in the continuous and swift update of mine reserves, which requires a continuous and fast stream of the measurements of stopes in an underground mine rather than the chemical lab analysis of core samples or chip/face samples. Here we propose using portable for the swift monitoring of ore grades. However, this "fast" data be highly uncertain. For this reason, the first step consists of creating a bidistribution function between "uncertain" XRF and the corresponding "hard" measurements, based on empirical historical data. Following this, the uncertainty of the XRF measurements is derived from those bi-distributions through the conditional distribution of real values given to the known XRF measurement.The second step involves updating the reserves by integrating this uncertain XRF data, which has been quantified by conditional distributions, in the grade characterization models. For this purpose, a stochastic simulation with point distributions is applied. A case study of a sulphide copper deposit illustrates the proposed methodology.