

Abstract:

The choice of cut-off grade can have drastic impacts on the economics of a mining project. Optimizing this parameter throughout a mine's life ensures the continued maximization of value. Unfortunately existing theories and techniques have failed to provide a complete solution to the cut-off problem and often produce strategies that run counter to industry professionals' intuition.

Current best practices for cut-off grade optimization are based on Lane's (1964,1988) theories. Although this work has provided many valuable insights, these theories do not consider future price uncertainty. By assuming future prices are known with certainty these theories lead to sub-optimal cut-off grade strategies and excessive waste. In this paper a new method for cut-off grade optimization is presented. This method not only extends Lane's work to include price uncertainty but also directly incorporates current industry-standard resource models and mine planning data.

Formally the technique presented is a new stochastic dynamic model. The optimization problem is formulated as a system of nonlinear partial differential equations which are solved numerically. This mathematical approach is well established in numerous applications. The algorithm produces valuations, sensitivities and optimal cut-off strategies for use in project evaluation, mine operation, hedging strategy determination, mine design and risk management. This new approach provides greater insight into the sources of value inherent in mining assets, as well as helping management optimize their projects in the face of ever changing economic conditions.

Biography

Drew Barr graduated from his Mining Engineering undergraduate degree at Queen's in 2007. He subsequently worked in mining software consulting for several years. Drew returned to Queen's in 2010 to pursue a Masters in Mineral Economics. His work under Jim Martin is focusing on real options applications in mine operation and valuation. In addition to his research at Queen's Drew has spent work terms at Kinross Gold in their Corporate Development group and at the Bank of Montreal in their Mining Investment Banking team.