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Dynamic Concepts for Mine to Mill Operation and Optimisation

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ABSTRACT

Feed ore variability, the major disturbance into a mineral processing plant receives considerable attention operationally, research and strategic levels to ensure that the throughput of the ore (cash flows) are maintained at all times whilst encouraging a sustainable approach to recovering the valuable minerals from ore bodies. Effort and insights from mineralogical and processing characterisation (eg. ore hardness) of sub-ore body domains allows sequencing for processing to ensure consistency and throughput for the size sensitive grinding unit processes. Optimising the blast fragmentation has benefit as does the pre-concentration using ore sorting. Blending of ore domains with different characteristics is common for operations. In recent years a number of technologies have become available for on-line and more rapid assessment of ore and have been discussed in a recent paper by Cameron et.al. as an opportunity for further utilisation of mine-to-mill (and mine to product) strategies. Current concepts have focused on extensive characterisation of ores so that current control practices can be realised and made more effective with relatively slow measurements and actuation.

This paper raises the spectre of a different approach, where fast real-time measurements of ore influences in the grinding stage with time scales much faster than the operational time constants of a processing so that it can be adjusted 'on the fly' to maintain throughput and provide a consistent feed to the next stage, i.e. flotation. Considerable work using acoustic arrays with SAG and AG mills has shown that this alternative approach has merit considering that in-mill operational changes due to ore hardness (mineralogy), shape, size, the influence of water addition etc. can easily be witnessed with non-contact acoustics on time scales of tens of milliseconds. This paper will contrast and explore this new concept, using real data, for the new paradigm for the optimal processing of ore bodies.