A Novel Strategic Planning and Sequencing Optimisation Model for Fully Mobile In-pit Crushing and Conveying (FMIPCC) Systems

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# ABSTRACT

Conventional open pit metalliferous mines are generally large in scale and operation. As open pit mining proceeds to greater depths and at decreasing ore grades, the energy required to produce each unit of valuable metal increases. Truck haulage reliant operations will typically experience higher operating costs due to longer haulage distances. In recent years, there has been a growing focus on the environmental impacts of mining, particularly the need to reduce greenhouse gas emissions associated with energy-intensive processes such as material handling. In-pit crushing and conveying systems (IPCC) are an alternative to conventional truck haulage. These systems integrate materials handling and comminution as a continuous system and often reduce operating costs at the expense of increased capital costs.

One of the main types of IPCC systems is Fully Mobile In-Pit Crusher Conveyor (FMIPCC) systems. The feature of this system is that the crusher is fed directly by a digging unit at the working face. A network of conveyor belts then transports material to either a waste dump, stockpile, or process plant. This system removes the need for truck haulage, however, it requires a robust mine plan to execute due to a loss of flexibility in mine sequencing. At present, there are no commercially available tools to generate and assess strategic mine plans of metalliferous deposit using FMIPCC systems. This paper presents a newly developed Mixed Integer Programming (MIP) optimisation model using direct block scheduling for application to FMIPCC systems to generate strategic mine plans. The objective collectively contributes to the development of a robust mathematical model that addresses unique FMIPCC system challenges by formulating various operational constraints. A conceptual case study based on the Marvin block model is presented which validates compliance to key sequencing requirements for FMIPCC.