Towards a system for integrating open-pit mine production scheduling stages

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ABSTRACT

When optimising production scheduling of open-pit mines, there are three main mine production scheduling stages that are generally considered. These stages are long-term, medium-term and short-term production scheduling stages. Since the early applications of optimisation techniques in mine planning in the 1960s, several exact and approximate algorithms and techniques have been developed to solve the mine production scheduling problem. However, most of these optimisation algorithms and techniques have been used to optimise either long-term, medium-term or short-term production scheduling as separate standalone stages not as interconnected stages within the system. When production scheduling stages are optimised as isolated standalone stages, it is often detrimental to holistic optimisation of the overall scheduling system as each separately optimised stage can be spatially or intertemporally misaligned with its consecutive upstream or downstream scheduling stages. A misaligned production scheduling system can result in mineral resource sterilisation or reduced economic value expressed using net present value (NPV). However, when production scheduling stages are aligned, the overall production scheduling system can ensure that long-term objectives are achieved at medium-term scheduling horizons, and in turn, the medium-term objectives are also achieved at short-term scheduling horizons. This paper used a PRISMA-based bibliometric mapping of production scheduling optimisation techniques to highlight potential future research that can be undertaken to improve optimisation of the open-pit mine production scheduling system. Lastly, the paper presents a case study example to demonstrate that an integrated production scheduling system generates a higher NPV, while achieving improved spatial and intertemporal alignment between consecutive scheduling stages, compared to when optimising a production schedule as an isolated stage.