

Long-term planning in open-pit mining with integer programming^{*}

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Abstract. A critical aspect of long-term open-pit mine planning consists in designing a block extraction schedule. Such a schedule should specify when and if blocks should be extracted in such a way as to maximize the net present value (NPV) of the mine, while satisfying wall-slope and production capacity constraints.

It is well known that this problem can be modeled with integer programming. However, integer programming is not used in practice because the size of typical block models makes such problems intractable to standard solvers.

Instead, modern software packages typically use variations of nested-pit approaches based on the algorithm of Lerchs and Grossman. These typically begin by constructing a sequence of nested pits. From these they define phases, which are then scheduled bench-by-bench.

In this talk we present a scalable integer-programming based methodology for solving very large (millions of blocks) instances of this problem. We begin by developing customized integer programming techniques (pre-processing, branching, cutting and heuristics), which allow us to solve medium-sized instances to near optimality. Embedding this technology in a local-search based algorithm, we are able to obtain near-optimal solutions to large problems in reasonable time. We test this methodology on several real mines, and compare the solutions to those obtained by mine planners using a classic approach.

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