DC Programming Biobjective Approach for Solving an Applied Rougher Flotation Optimization Problem

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We propose a deterministic mathematical programming approach to optimizing the metallurgical performance and determining the best operating conditions of the rougher flotation process. Our methodology is based on several advanced modern mathematical programming and multiobjetive optimization techniques including DC programming and the special global search strategy [1], an exact penalty method [2], and the ε-constraint algorithm [3]. The aim is to find the operating conditions of the flotation process that lead to the concentrate grade and recovery maximization subject to some technological constraints.

We develop a framework for finding an approximation to the Pareto optimal set of the bi-objective DC problem that assumes its decomposition into series of subproblems (DC programs with a DC constraint). Each subproblem is then solved to global optimality, providing a Pareto optimal solution to the bi-objective DC problem. To this end, we develop a solution method based on the global search theory proposed in [1]. According to the theory based on the global optimality conditions, the process of searching for global optimal solutions to the nonconvex optimization subproblems consists of the two principal components: (i) a special local search procedure taking into account the structure of the problem, and (ii) a procedure of escaping from critical points found by the local search that presupposes using special global optimality conditions.

We demonstrate the effectiveness of the proposed approach by carrying out a case study for real rougher flotation of copper-molybdenum ores performed in the Erdenet Mining Corporation concentration plant (Erdenet, Mongolia).

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