Determination of Optimal Block Size in Angouran Mine Using VIKOR Method

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Abstract
Size optimization of mining blocks is among the most important factors for optimal planning and systematic extraction in a mine. Several technical and economic factors are effective in determining the size of mining blocks. The best size of blocks complies with geostatistical criteria appropriately and reasonably and is relatively favorable compared to other extractive, technical and economic criteria. In this regard, the use of multi-criteria decision-making methods is useful since it enables simultaneous consideration of the impact of several criteria with different relative importance. In this paper, while introducing a comprehensive suite of effective criteria to determine the optimal size of mining blocks using multi-criteria decision-making method of VIKOR, 10-meter blocks were recommended as the best option (most appropriate size) for Angouran mine.

Keywords: Optimal Block Size, Angouran Mine, Block Modeling, Multi-criteria decision-making, VIKOR method

1. Introduction
Today, human ability to extract lower grade minerals has been considerably improved with advances in technology and increase in the value of minerals. In this regard, the use of three-dimensional modeling is inevitable to estimate the exact amount of deposit as well as do detailed planning for mining and ore production. Three-dimensional modeling can be effective in control of mineral mixing in different sectors in addition to consideration of the production plan. Several processes including geological modeling, phasing, design and so forth are involved in the process of three-dimensional modeling. Block modeling, also known as ore body blocking, is one of the most important steps in which the mineral deposit is divided into a series of separate blocks. The size of blocks is the most important parameter influencing the block design and optimal selection of blocks. Estimation variance is an important determinant of block size. Ore grade estimation in smaller blocks is far more difficult than larger blocks, since bases with larger size have lower variability according to the central limit theorem. Moreover, the higher the grade distribution in a deposit, the less accurate the grade estimate in it [1]. In addition, several direct and indirect costs are associated with mining, and some costs such as drilling expenses differ depending on the block size. Therefore, the costs can be reasonably reduced by determining optimal size of the extracted blocks. Optimizing the net present value (NPV) according to geostatistical data and limitations as well as extraction facilities and equipment is an important factor in determining the block size and shape. In addition, extraction parameters including geo-mechanical problems, capacity of mining machinery especially loaders play an important role in determining the block size. Finally, blocking and block modeling determine the deposit and correct advancing direction for mining operations. Given the impact of several measures in determining the size of blocks, it is not possible to determine optimal block size by relying on engineering judgments without a scientific and efficient approach. The use of multi-criteria decision-making methods is very useful as it allows simultaneous consideration of several criteria by taking into account the different relative importance attached to them. In this paper, while introducing a comprehensive set of effective criteria to determine the appropriate block size, the best option (most