

Qualitative and quantitative analysis of hangingwall caving in longwall mining method using a fuzzy system

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ABSTRACT

Caving process is an important part in extraction sequences in caving methods such as longwall. Therefore qualitative and quantitative analysis of the caving can be useful to observe the conditions of the hangingwall and to predict the behavior of hangingwall during the face advance, planning the extraction operation and at last make true decisions in each condition. In this study, the parameters affecting on caving has been classified in four groups. These groups are: mechanical, geometrical, operational and geological parameters. Using fuzzy logic, the quality of caving according to these parameters and the factors resulting by them such as stability time, bulk factor, average particle size of the caved strata in the gob area and overhanging length has been analyzed. The results of analysis show that caving quality increases with increasing in bulk factor and decreasing in stability time, average particle size of the caved strata in gob area and over hanging length. The model was used for Tabas ParvardeV coal mine, located in Parvarde district, Yazd province in Iran. The results show medium to low quality for the siltstone and the sandstone layers in the immediate roof. The results also show a good convergence between the theoretical analysis and the mine observations.

Keywords: Longwall mining, hangingwall caving, stability time, bulk factor, strata, gob area, over hanging, Tabas Parvarde coal mine.

INTRODUCTION

Caving process is one of the most important extraction sequences in longwall mining method. prediction of composite layer behavior in hangingwall, before, during and after each stage of coal seam extraction and caving, plays an important role in production planning and depends on good recognition of hangingwall, parameters affecting on caving and composite layer behavior. Therefore presenting a model with ability of or. These approaches can be categorized into some groups such as analytical, geological, observational, and empirical methods, etc, for better recognition of roof strata conditions. Of these approaches, the empirical methods, typified by the rock mass classification systems and originally developed for tunnels (Wickham et al., 1972; Bieniawski, 1974), have been successfully modified for use in hard rock mines (Laubscher, 1977; Kendorski *et al.*, 1983).

explaining the characteristics and conditions of roof strata and predicting the hangingwall caving behavior is to be seen very important.

Because of the complicated conditions and too many effective parameters, the model must be able to gather all the effects of parameters and explain them together correctly and then present results with lowest error.

Many approaches are currently available for prediction of roof behavi

Classification systems for application to underground coal mines have been suggested by Ghose and Raju (1981) and others (Bieniawski *et al.*, 1980; Seegmiller, 1983; Unal, 1983; Thill, 1984; Karmis and Kane, 1984). Ghose and Dutta used fuzzy logic and fuzzy sets theory to present a classification model for caving roofs in longwall coal mines in India for the first time (1987).

In this study, fuzzy sets theory is used to model the caving process. Fuzzy method is chosen because of its ability to