



Review article

A review on application of acoustic signal analysis in rock drilling operation

Mojtaba Yari^{1*}, Raheb Bagherpour², Mehrbod Khoshouei²

1- Dept. of Mining Engineering, Faculty of Technical and Engineering, Malayer University, Hamadan, Iran

2- Dept. of Mining Engineering, Isfahan University of Technology, Isfahan, Iran

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English Extended Abstract

Summary

In this paper, a review of research conducted on the application of acoustic signal processing during drilling operations in both laboratory and field scales has been done and the advantages, challenges and application of analysis and processing of these waves in drilling operations are discussed. From the studies performed, it can be concluded that the processing of acoustic waves during drilling operations is an accurate, non-destructive, inexpensive and reliable method for various purposes such as reducing drilling costs, optimizing operations and parameter selection optimal operational parameters fit to the rock excavation.

Introduction

Rock drilling is one of the main operations in quarrying and mining engineering [1]. Investigation and predicting the physical and mechanical properties of rock is one of the most important activities in various projects of mining engineering, especially drilling operations. The use of acoustic waves in recent years in the form of recording and analysis for various applications, using various techniques has received much attention. Acoustic emission techniques are among the most accurate experiments that can be used to condition monitoring, predict material properties or equipment conditions, such as predicting penetration rates, selecting appropriate drill bits.

Methodology and Approaches

Acoustic signal propagation is one of the outputs of most processes in mining operations that the use of these signals and their processing can be very useful. The general process of processing acoustic signals is that during the process, the sound wave that is produced is recorded by special sound recording devices such as microphones or sound level meters[2]. Then, according to the required processing level, the signal is processed and its characteristics are extracted from the main wave. Figure 1 shows the signal recording and processing process.

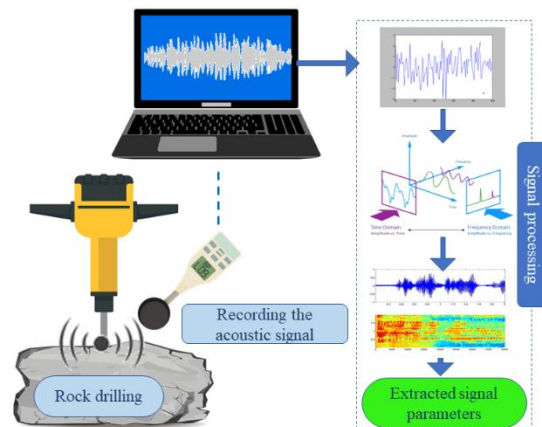


Fig. 1. Signal recording and processing process in rock drilling

After processing and extracting information from the signal, it can be used for statistical evaluations and modeling for purposes such as predicting and calculating the physical and mechanical characteristics of rocks at any time of drilling [3-5], monitoring the behavior of drilling equipment and drilling bits or detecting phenomena such as drill bit breaking time [6]. So far, these waves have been widely used in laboratory studies and satisfactory results have been obtained [7]. The use of these waves along with the drilling machine as a tool in real operations in the mines can be very helpful in better understanding the drilling conditions and lead to the optimization of drilling operations and reduce drilling costs.

Results and Conclusions

Based on the studies conducted in the application of acoustic emission techniques, it can be concluded that there are various methods and techniques for processing acoustic signals, which can be used to extract features from the time spectrum or frequency domain of signals or correlate these properties with various properties such as physical and mechanical properties of rocks or monitoring the equipment. Applying new methods in acoustic signal processing can greatly contribute to the future of experiments and operations in earth sciences and geotechnics in various fields such as exploration, drilling engineering, material processing, rock mechanics experiments, etc. Most methods of testing, status monitoring and detection become a tool with drilling operations. The use of this technology, in addition to more accurate identification of the type and characteristics of rock or material and other structural features such as joints, faults and rock cavities, can also optimize drilling operations by adjusting drilling operational parameters such as The weights on the bit (WOB) and the rotation speed of the drill bit. In this way, the costs of drilling processes, which are one of the most important parts of various mining operations, can be greatly reduced.

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