NEW SEISMIC PREDICTION OF GEOLOGICAL STRUCTURES AHEAD OF THE TUNNEL USING REFLECTION WAVE

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As a special underground building structure, more attention has been given to the tunnel. The uncertainty in rock structure, such as faults, may have a significant influence on the schedule and safety of the tunneling project. Characterized by wide detection range and high resolution, the tunnel seismic detection prediction has become a major technique. Conventional approaches, for instance, Tunnel Seismic Prediction (TSP), are based on reflection data from the tunnel wall to detect the rock structure in front of the tunnel; however, there are indispensable disadvantages, such as low spatial resolution, less reflection information, none-unique interpretation and difficulty in identifying refection wave. In this paper, we propose a new method-Tunnel Seismic Reflection Prediction-to tackle the problems above. A numerical stimulation of wave field has been conducted to analyze the merits and demerits of conventional methods. On this basis, we put forward the new data acquisition method with observation system deployed on the tunnel face; and simultaneously, not only the feasibility, limitation and data processing mode of the method, but also the wave field characteristics and the processing mode of the forward data have been analyzed. Based on forward results, this method has been applied to the acquisition and processing experimental research of actual data. By analyzing the forward data and actual data, we find that the reflection data obtained by this method has characteristics of strong energy, high signal-to-noise ratio and spatial resolution. Moreover, it is easy to identify the reflection information of the geographical bodies, which is conductive to the processing of data and location of the abnormal geographical bodies. Our approach has been verified successfully in a field experiment.