Abstract

This study examines the significant effects of anthropogenic seismic activity in underground mining on safety, productivity, and operational expenses. The precise identification of microseismic and rockburst source areas is essential for preventing unexpected occurrences like rockbursts. The existing constraints in forecasting the timing of these occurrences need an emphasis on likely locales. The study seeks to address this constraint by creating an approach that monitors and adjusts to alterations in ground conditions, offering a real-time solution for the selection of suitable velocity models in seismic monitoring systems. This approach aims to enhance the reliability of source location computations by accounting for the dynamic velocity model in underground mining environments, hence improving worker safety and mining productivity. The research acknowledges the changing properties of rock masses and voids during mining, emphasizing the insufficiency of a constant velocity model in source localization methods. This study utilized data produced from laboratory studies that simulated the continuously changing environment of underground mines. Analysis indicates that, because to the heterogeneity and ongoing fluctuations in the mining environment, seismic wave velocity cannot be regarded as a constant in source localization methods. Real-time prediction of seismic wave velocities markedly improves the precision of seismic event source localization. Dynamic numerical modeling in FLAC3D, utilizing laboratory data, was utilized to comprehend wave propagation and the underlying physics of the issue. Machine-learning techniques, such as Linear Regression models utilizing laboratory data and Deep Artificial Neural Networks for enhanced accuracy, were employed to forecast seismic wave velocities under diverse scenarios.