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Site-specific rock-fall parameters in a hard rock open pit environment.

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Abstract

This research report is focussed on rock-fall in an open pit mine. Rock-fall is a well-known hazard in open pit mining, housing, and railway and road cuttings. The prediction of accurate rock-fall trajectories is vitally important to ensure the safe construction and operation of these projects. All current rock-fall software uses stereomechanical impact theory, which assigns Normal and Tangential Coefficients of Restitution (CoR) to a collision where permanent deformation is experienced. The Kinematic CoR describes the amount of energy lost as a ratio between energy before and after impact. The Tangential CoR and Normal CoR are vector components of the Kinematic CoR.

Rock-fall modelling is reliant on the specification of a representative Coefficient of Restitution to enable the determination of accurate rock-fall trajectories. This is currently done by adding statistical variation to the CoR to establish different possible rock-fall trajectories. The output is used in rock-fall barrier or geotechnical catch berm design for slopes. Different ways to establish the most applicable CoR for rock-fall modelling were studied through in-situ testing, with associated calculations, software calibration, and laboratory testing. From the in-situ testing, three correlations were found to estimate the trajectories of rock blocks with good accuracy.

A negative exponential correlation was found between the impact energy and Kinematic CoR, known as “ESCORSE”, the **E**nergy **S**pecific **CoR S**election **E**nvelope. Two separate linear correlations between the Kinematic CoR and Tangential CoR, and, Kinematic CoR and Normal CoR were determined. The influence that this research will have on rock-fall simulations is that the selection of a CoR is not only dependent on the rock type, but also on the energy conditions at impact - once the rock has passed the elastic impact boundary, the greater the impact energy the greater the energy loss due to fracturing.

Further study is needed to define the ESCORSE for softer and harder rock types, including the linear relationships between the Kinematic CoR and Tangential CoR, and, the Kinematic CoR and Normal CoR.