

Safety-critical Alarming Strategy Based on Statistically Defined Slope Deformation Behaviour Model Case Study: Upright-dipping Highwall in a Coal Mining Area

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Abstract : Slope monitoring program has now become a mandatory campaign for any open pit mines around the world to operate safely. Utilizing various slope monitoring instruments and strategies, miners are now able to deliver precise decisions in mitigating the risk of slope failures which can be catastrophic. Currently, the most sophisticated slope monitoring technology available is the Slope Stability Radar (SSR), which can measure wall deformation in submillimeter accuracy. One of its eminent features is that SSR can provide a timely warning by automatically raise an alarm when a predetermined rate-of-movement threshold is reached. However, establishing proper alarm thresholds is arguably one of the onerous challenges faced in any slope monitoring program. The difficulty mainly lies in the number of considerations that must be taken when generating a threshold because an alarm must be effective that it should limit the occurrences of false alarms while also being able to capture any real wall deformations. In this sense, experience shows that a site-specific alarm threshold tends to produce more reliable results because it considers site distinctive variables. This study will attempt to determine alarming thresholds for safety-critical monitoring based on an empirical model of slope deformation behaviour that is defined statistically from deformation data captured by the Slope Stability Radar (SSR). The study area comprises of upright-dipping highwall setting in a coal mining area with intense mining activities, and the deformation data used for the study were recorded by the SSR throughout the year 2022. The model is site-specific in nature thus, valuable information extracted from the model (e.g., time-to-failure, onset-of-acceleration, and velocity) will be applicable in setting up site-specific alarm thresholds and will give a clear understanding of how deformation trends evolve over the area.

Keywords : safety-critical monitoring, alarming strategy, slope deformation behaviour model, coal mining

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