DEPARTMENT OF MINING ENGINEERING RESEARCH

Developing a quantitative measuring technique to physically capture and study the in-flight motion of flyrock in order to improve on predictive models and to better understand the causative factors

The flyrock monitoring project of the AEL Intelligent Blasting Chair in Innovative Rock-breaking Technology in the Department of Mining Engineering was originally initiated through a request from a Glencore coal mine to assist with the evaluation of its mathematical model and its empirical standards for predicting the safety radii to protect equipment and personnel from flyrock.

The insight obtained from this project highlighted the dearth of work done in the past, internationally, in an attempt to understand this phenomenon. The present study started with a more extensive literature review, which showed that – despite the numerous and theoretical predictive models developed over the past ten years – no definitive measuring technique to properly test these theories exists.

The next step was to identify the most appropriate technology to measure the flight path of flyrock in the aftermath of a blast. Photogrammetry was selected as the technique most likely to succeed. Normally, photogrammetry involves taking several photographs of a static object from different angles using a single camera. The photographic data is then manipulated to yield a 3D image of the object.

In the case of flyrock monitoring, the process had to be reversed to a technique where several cameras were used to capture a moving object. The data would then be manipulated to depict the trajectory of the flyrock in 3D. This technique was developed and perfected by employing a clay pigeon sling in a controlled and demarcated space. Finally, the multiple camera system was deployed in a quarry where photographs of flyrock were successfully captured by all the cameras.

The study is currently concentrating on converting the quarry photographic data into a point cloud form from which the trajectory of the flyrock can be calculated. This work serves as the basis of research for a master's degree dissertation.
Subsequent work will focus on extracting positional and physical data of the flyrock fragments from the photographic data using existing photogrammetric and stereo mapping software. Once the positional data can be obtained within an acceptable margin of error (±1 cm), the research focus can shift towards the analysis and interpretation of the data based on ballistic principles.

The ultimate goal is to determine two coordinates for the flyrock: its final landing position and the point of origin. This output will enable mines to build historic databases of the operation's flyrock. It will also enable researchers to quantitatively investigate the effect of various blasting parameters on the risk of flyrock, and will enable the visualisation of the data for training and educational purposes.

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