Prediction of Blast-Induced Ground Vibration Using Artificial Neural Networks in a Diamond mine

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Abstract

Blasting is the most common method of rock breaking in mining and civil engineering. When explosive detonates, it generates huge amount of energy and only small fraction of energy breaks the rock while the rests results in undesirable environmental effects such as ground vibration, airblast, flyrocks etc. The aim of this paper is to predict blast-induced ground vibration using Artificial Neural Network (ANN). The following blast design parameters were used as our input parameters: Burden, spacing, blasthole depth, blasthole diameter, and stemming length, distance from the blast face, powder Factor, maximum charge. Ground vibration was regarded as output parameter. To validate the results of the developed, ANN system predicted results was compared with developed empirical formulas and multivariate regression analysis. In addition, sensitivity was quantified and analysed. A three-layer MATLAB based Artificial Neutral Network (ANN) was developed and trained with Levenberg–Marquardt algorithm using 94 blast datasets. The ANN model with 8-14-3 architecture was found to be the optimum when compared to other empirical formulas and multiple regression analysis model using coefficient of determinant (R^2) and root mean square error (RMSE). Lastly, sensitively analysis was conducted to quantify the influence of each input parameter on airblast, ground vibration and rock fragmentation.

Keywords—*Artificial Neural Network, Blasting and Ground Vibration*

Biography

Mr Kesalopa Gaopale is a postgraduate student studying (Masters Engineering in Mining) and teaching assistant at Botswana International University of Science and Technology (BIUST). He is also a research assistant at BIUST's Simulation Machine Learning, Robotics and Technopreneurship (SMaRT) Laboratory. He holds dual degree in BSc Mining Engineering and BSc Economics from Missouri University of Science and Technology (USA) with a cumulative grade point average (GPA) of 3.66/4.



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