Abstract

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Intelligent Prediction of Induced Tensile Stresses in Unlined Rock Tunnels Using Artificial Neural Network Under Effect of Explosion Loads

The numerical simulation of explosion in rock mass is extremely demanding, requiring hydrodynamic computer codes, combined with non-linear dynamic codes based on finite elements which is a very complex approach. The Artificial Neural Network (ANN) is used to simulate the elasto-plastic behavior of the unlined tunnel subjected to explosion loads. The simulation was conducted utilizing the original numerical results collected from the AUTODYN program for the vertical-side-wall tunnels. The main aim of this paper is to investigate the induced stresses in rock mass at the tunnel crown under blasting vibrations and the effect of different of rock mass qualities on the wave propagation associated with the explosion. The data base used in the ANNs analysis consists of various values of Rock Mass Rating (RMR), tunnel radius (R), charge weight (W), crown-detonation distance (D) and (W/D) ratio as input data and the values of induced tensile stresses as output data. Results of 72 AUTODYN models which simulated the unlined tunnel were used for training and testing the network, respectively. The analysis shows that the predicted values of tensile stresses computed by Artificial Neural Network analysis showed good compatibility with the results of the complicated finite element analysis.