COMPUTER MODELING OF ROCK MOTION

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ABSTRACT

A computer model of rock motion due to blasting is presented. The code, CAROM, was developed at Sandia National Laboratories (SNL) to predict rock motion and final muckpile distribution. Researchers at the Bureau of Mines applied the code to simulate bench blasting during full-scale fragmentation tests at a nearby rock quarry. Results of the code are shown for the first 2 s following explosive detonation.

INTRODUCTION

A contributing factor to the overall efficiency of surface mining is the final muckpile distribution of the blasted rock fragments. This is especially true in mining operations utilizing overburden casting to reduce stripping costs. As the overburden-to-coal ratio increases, it is essential, in many operations, that as much fragmented rock as possible be thrown into the pit or onto the spoil bank.

To optimize overburden casting, mine operators most often vary powder factor, explosive type, drill patterns, and/or delay timing. These variations are normally tested by trial and error based on the experience of blasting personnel. Unfortunately, this can often be time consuming and expensive. An alternative approach to the optimization problem, which can quickly analyze technical problems, involves computer-simulated blasting.

Much of the early work to develop simple and effective computer models to simulate blasting was done by SNL. In 1983, researchers developed BUMP (1), the first code to use very simple interaction laws to reduce computational times. A stabilized and improved code, CAROM (2), was later introduced. Both codes were written to study rock motion in oil shale crater tests.

The Bureau of Mines initiated contract J0245011 with SNL to modify these codes for use in modeling bench blasting. Subsequently CAROM was modified and used in blast design research. SNL staff also provided appropriate values for input parameters to execute the code.

MODEL DESCRIPTION

The CAROM code is a two-dimensional distinct-element code. That is, a group of distinct elements is used to describe the system of rock fragments undergoing motion. The shape of these elements is in theory arbitrary, but circles are most often used to simplify