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Otto E. Crenwelge, Jr. and Timothy A. Peterson
Shell Development Company
P. O. Box 1380
Houston, Texas

ABSTRACT

We have developed a site-specific method for analysis, prediction, and control of ground vibrations induced by overburden blasting operations in surface coal mines. Field tests conducted at R&F Coal Company have verified our approach for obtaining signatures of the overburden vibration characteristics at locations of interest near the mine, selecting the optimum excitation frequency for minimizing vibrations, measuring and synthesizing multiple-charge excitation signals for minimizing vibration amplitude and duration and controlling frequency, accurately predicting the multiple-charge vibration response in both the time and frequency domains, and accurately controlling the blast detonation to achieve the predicted vibration control. Initial field studies also indicate that by minimizing the vibrational energy radiated from the blast zone, and by optimizing the number of charges detonated per delay period as allowed by this technique, more effective use of the explosive energy is obtained within the blast zone itself for improving overburden fragmentation, swell, and cast. In all of the phases of this technique, including actual blast detonation, personal computer hardware and software have been verified for use in either field or office environments.

Our approach is somewhat similar to that of Anderson, et al, 1985, in that both use measured single-charge ground response data in rigorous theoretical approaches to predict multiple-charge response. However, Anderson's time domain superposition approach presently limits his predictions to cases of linear vibration encountered when using small charge weights to produce small deflections. Our approach, convolution in the frequency