IMPLEMENTATION OF A USER DEFINED MINE BLAST MODEL IN LSDYNA

Mark Tyler-Street, Piet-Jan Leerdam

TNO, Lange Kleiweg 137, 2280 AA Rijswijk, The Netherlands.
E-mail: mark.tylerstreet@tno.nl, piet-jan.leerdam@tno.nl

Key words: Mine blast; STANAG 4569, Load model; Finite Element Method, LSDYNA

Abstract
An analytical user defined mine blast model is being developed and implemented into the explicit finite element code LSDYNA in order to provide an efficient method for simulating the effects of a buried mine blast. This includes the two distinct testing configurations of STANAG 4569, the steel pot and saturated sandy gravel.

The existing analytical blast models implemented in LSDYNA include both hemispherical surface and spherical air burst (Randers-Pehrson & Bannister). Whilst they may be applied for an initial study, these models are not able to simulate the important characteristics of a buried mine blast. They do not include the focusing effects of both the steel pot and a buried charge and hence the distribution of the applied loading is incorrect. The analytical model developed by Westine et al provides a more detailed description of the loading due to a buried charge but does not include the STANAG steel pot configuration.

The analytical blast model being developed at TNO uses data from both detailed finite element simulations and experiments. The objective is to provide a simple and robust model with an improved description of the loading resulting from both a buried charge and a steel pot. The user loading function calculates the loading on the geometry of the vehicle external surfaces depending upon the charge configuration.

Output is provided in LSDYNA binary format, in addition to the standard d3plot files. A blast_parameter file provides a comprehensive description of the calculated mine blast load, showing the distribution of various parameters (for example: range, scaled distance, angle of incidence, reflection coefficient, peak incident pressure and impulse). The history of the applied blast and impulse during the simulation is provided in a binary format.

The resulting implementation of the mine blast model will enable a range of different mine and soil conditions to be represented efficiently and the effects of the loading on the vehicle structure to be evaluated.

References (to be completed later)
Randers-Pehrson & Bannister

Westine et al