Numerical Simulation of Mine Blast Loading on Structures

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Introduction

The design of vehicles to resist mine blast is of great interest to the international community who would like to provide an appropriate level of protection for vehicles and their occupants. Full size mine blast trials are expensive and time consuming to organise. However, using numerical simulations to predict the interaction of the mine blast with the vehicle can minimize the number of such trials.

This paper describes a mine blast simulation methodology that has been developed within the AUTODYN software[1]. This methodology can be used with surface-laid or buried charges and calculates both the air blast loads applied to a structure and momentum transfer due to soil or other materials impacting with that structure. The complexity of the target geometry is not limited by the methodology

The results of simulations are compared with experiments conducted by DRDC Suffield using an instrumented horizontal Mine Impulse Pendulum (MIP), as described in two papers presented MABS [2], [3].

Finally, the methodology is applied to simulating mine blast effects on a complex vehicle structure.

4.2 Dynamic Loading on Rectangular Structures with Openings 4.3 Dynamic Loading on Open-Frame Structures.Â The analysis and design of structures subjected to blast loads require a detailed understanding of blast phenomena and the dynamic response of various structural elements. This gives a comprehensive overview of the effects of explosion on structures. III.Â Numerical (or first-principle) methods are based on mathematical equations that describe the basic laws of physics governing a problem. These principles include conservation of mass, momentum, and energy.Â A methodology has been proposed for the creation of inflow properties in uncoupled and fully coupled Eulerianâ€"Lagrangian LS-DYNA simulations of blast loaded structures. Numerical simulations for blast-Ââ€loaded laminated glass are still not fully investigated and established. Several detailed questions should be solved and further numerical models should be developed to use numerical simulations for all limit states. This report gives first an introduction to numerical simulations followed by a chapter on how finite element simulations can be used to assess the behaviour of laminated glass and windows.Â Numerical simulations may help to develop new kinds of materials or structures. These structures can be tested numerically before expensive experiments are conducted. Numerical simulations can help to investigate the different parameters of the windows relevant to the design. Simulations of the response of concrete structures subjected to AIR blasts. Peter svantesson. Masterâ€™s Dissertation.Â A FOI report investigates the possibility to use a simplified numerical model of reinforced concrete slabs to simulate the response from blast loads and quasi static loads. The model is based on three-dimensional solid elements and a combined concrete/steel material model. The results are compared to an experimental study. Air Blast Loading of Remote Detonation. The air blast load can be displayed schematically as a pressure-time curve (from [2]). Image - Pressure-time course of a remote explosion. The free air shock wave hits the structure abruptly with peak overpressure. The curve includes an overpressure period acting on the structure until the time period td is reached, and which is reduced by an underpressure period until the ambient air pressure is reached. This exponential approach is often simplified to the overpressure region. In this case, a virtual time t~d (t~d < td) can be calculated, which describes the approach linearized with the same amount of momentum, but completely neglecting the under pressure period.