CYLINDRICAL SIMILARITY LAWS FOR VERY HIGH RATIO LENGTH/DIAMETER

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The blast similarity laws, for example Hopkinson or Sachs laws, are used very often to predict large scale or small scale blast parameters for safety and performance issues in a spherical geometry. The blast effect of cylinder charges has been also studied with various L/D, generally up to few tens. We are interested by the blast effects of very long cylinders with L/D more than 500. The objective of the paper is to present cylindrical similarity laws for PETN and HMX based pressed HE. These laws are determined by numerical simulations and then compared with experimental results.

The numerical simulations are performed with Ouranos hydrocode using gamma variable equation of state for air and a specific equation of state for the detonation products in 1D cylindrical and 2D axi-symmetric configurations. For the 2 D configuration, a 4 m long detonation cord is detonated from one end. The pressure tracers are implanted at 2 m height for different stand-offs. Different cord diameters are calculated for PETN and HMX based pressed HE. The influence of the meshing is investigated. The pressure versus distance curves are presented.

The experimental set-up is prepared with a 4 m long vertical detonation cord. Two PETN based cords are tested. The pressure gauges are positioned at 2 m height for 0.2, 0.3 and 0.4 m stand-offs. The experiments are compared with the numerical simulations. The similarity laws are proposed for very high L/D.