EXPERIMENTATION AND MODELLING OF NEAR FIELD EXPLOSIONS

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ABSTRACT

Repeatable experimental results and numerical work has shown that using the Jones-Wilkins-Lee (JWL) equation of state (EOS) will give very accurate results of peak pressures and impulse delivered to a rigid target at large scaled distances. However, recent experiments/numerical modelling at small scaled distances show that the JWL will over-predict peak pressures and impulse due to the assumption of (near) instantaneous energy release from detonation. The results of this experimental/numerical study are presented herein. In the experimental work PE4 spheres at two different scaled distances have been tested using an array of Hopkinson Pressure Bars (HPB) at specific points on a rigid target to measure the local pressure-time histories. From the HPB measurements, it appears that below certain scaled distances there are chemical-physical mechanisms that do not have sufficient time to contribute to the energy driving the loading mechanisms, explaining the over-prediction of the JWL. Importantly though, the experimental results show that at very small scaled distances (0.172 m/kg$^{1/3}$) the test to test percentage variation is very low (5.1%); whilst at larger scaled distances (0.819 m/kg$^{1/3}$) it is much higher (23.1%). This paper presents a model which describes the process by which experimental results move from repeatable to variable to repeatable as scaled distance increases from the extreme near field to far field.