A MODEL FOR BEHIND ARMOR DEBRIS FROM EFP IMPACT

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ABSTRACT

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When a projectile is perforating a target, a cloud of debris is spread out behind it. The debris emanates from the target and projectile material. The cloud in which the fragments move is often described as a hollow ellipsoid. However, modeling of behind armor debris (BAD) is much more complicated than modeling penetration or hole size. This is due to the fact that there are many more degrees of freedom involved. Typically, there are a lot of debris fragments, which are to be described by mass, velocity and angular distributions. The complexity of modeling BAD is even higher when regarding hollow projectiles like non-ideal EFPs, as with hollowness an additional degree of freedom is added which has significant impact on the debris generation.

Several empirical and semi-analytical relations have already been developed to describe the BAD generated from rod impact. However, besides the missing applicability to hollow projectiles, most of them are either limited in their range of application (e.g. [1], [2]) or require input parameters that can only be determined in numerical simulations (e.g. [3], [4]).

From a series of BAD experiments with solid and hollow EFP simulants shot on RHA target plates at different velocities, the debris spread angles, the fragment masses and the fragment velocities were determined. Additionally, the EFP / target material distribution and the residual EFP lengths, which could not be determined from the flash x-ray pictures (Figure 1, left) were evaluated from numerical simulations (Figure 1, right).

Figure 1: Debris cloud from EFP impact: experiment (left) and numerical simulation (right)

From both the experimental and numerical results as well as from data available in literature a new BAD model was developed. All relevant model inputs are derived from an extended
Walker-Anderson model [5] that describes the target plate perforation. The BAD model then combines semi-analytical, statistical and empirical approaches to assess the fragment mass distribution and the fragment velocities in the BAD cloud. Additionally, to ensure the applicability to EFPs, semi-analytical functions considering the phenomena of hollow projectile impact are incorporated.

REFERENCES


