A STUDY ON SHOCK INTERACTIONS IN A SABOT SEPARATION PROCESS

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A sabot is a key element to launch anti- armor kinetic energy projectiles. Sabot separation is a highly unsteady and complicated aerodynamic process at the proximity of launch tube (transitional ballistic regime). Interaction of the sabot shock wave with the projectile creates unsteady aerodynamic loads on the projectile and this could adversely affect the trajectory of the projectile. Wind tunnel measurements of sabot discard reveal [1] that strong shock interactions are present in the annular region between sabot and projectile. Aerodynamic model called AVCO code was developed [2] to predict the trajectories of simple geometry sabots based on the wind tunnel data. Modern sabots are more complex because of the addition of a forward ramp for enhancing the strength. AVCO code was modified [3] to include these geometrical changes. However, transient nature of the angle of attack was not considered in the model, which induces unsteady effects of the shock interaction and reflection, consequently leading to complex unsteady aerodynamic loads on the projectile. Due to this reason, radial trajectories were over predicted in the AVCO code when applied to a sabot with a forward ramp, as it does not account for the shift in pressure peaking on the sabot windward surface and the moment generated owing to this.

The present study aims at analytically predicting the aerodynamic loads and trajectory of the sabot in the sabot discard process where a forward ramp is used in the sabot. The transient shock reflections in the annular region are analytically modeled using 1-D oblique shock inviscid gas dynamic equations to calculate the unsteady pressures generated along with the changing angle of attack. It is planned to predict the motion of the sabot by numerically solving the 6 DoF equations. It is also planned to conduct experimental studies to validate the analytical and numerical studies. Flow visualization using time resolved schlieren and estimation of the unsteady loads through image processing is also planned on a super scaled sabot model.

References

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