PENETRATION TRAJECTORY

RESPONSE SURFACE MAPPING TECHNIQUES

B.C. Patterson[1] and M.D. Adley[1,2]

[1] *U.S. Air Force Research Laboratory Munitions Directorate, 101 W Eglin Blvd Ste 309, Eglin AFB, Florida, USA (bruce.patterson@eglin.af.mil and mark.adley@eglin.af.mil).*
[2] *U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, Mississippi, USA (mark.adley@usace.army.mil).*

ABSTRACT

Practical applications that require the use of impact and penetration simulations often involve extensive parametric studies. The voluminous results of these parametric studies are then used to determine the optimum solution to the problem under consideration. Scientists and engineers at the Air Force Research Laboratory (AFRL) and the U.S. Army Engineer Research and Development Center (ERDC) are currently applying innovative data mining and visualization techniques to real-world weapon penetration mechanics problems to streamline the process of interpreting the results of large numbers of impact/penetration simulations. The goal of these efforts is to automatically generate, organize, and present the relevant information acquired from a large number of penetration mechanics simulations in a singe display that will enable analysts to quickly recognize and interpret trends in the results. This objective is met by using Response Surface Mapping (RSM) techniques to map penetration simulation results from Cartesian space into an alternate vector space that allows analysts to view large amounts of data in one chart. The algorithm used in this project employs nonlinear interpolation techniques to create the RSM charts and to determine how penetration simulation results vary with the parameters defining the alternate vector space. For instance, the algorithm can compute contours of constant penetration depth to determine which combinations of input parameters provide a given depth of penetration. The aforementioned type of RSM chart is also very useful for determining the level of damage resulting from embedded detonation problems where the depth of penetration is a primary factor that controls the degree of coupling and therefore the amount of target damage. The paper under consideration presents an overview of the approach used to create the RSM charts, and shows examples of the type of charts that have been found to be useful.