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A comprehensive study of fracture behavior of Armox 500T steel through stress state dependent damage model under high velocity ballistic impact

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ABSTRACT

A material model inherently accounting for stress state dependency improves predictabilities in dynamic impact loading simulations. In this presentation, we investigate the fracture behavior of Armox 500T steel upon ballistic impact by implementing a phenomenological Generalized Incremental Stress-State dependent damage MOdel (GISSMO) in LS-Dyna finite element modelling software. The computational work is firstly performed using Johnson-Cook material model to generate input data for GISSMO including the failure strain and stress-state parameters (i.e., stress triaxiality and Lode angle parameter). The GISSMO model with key inputs (i.e., failure and instability curves) for Armox 500T steel in LS-Dyna is implemented and validated against experimental data derived during mechanical and impact tests from the literature. Once validated, the model is expanded through a user sub-routine to account for strain rate and temperature on the material plasticity and fracture behavior. Overall, the present study generates insights in understanding strain-rate and stress-state dependent fracture behavior of Armox 500T steel under dynamic loadings and provides guidance to design of next-generation light armored vehicles. This work is in collaboration with Defence Research and Development Canada.

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