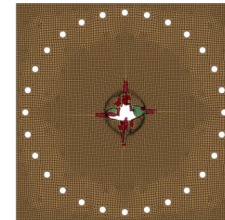# Structural Composites: Challenges and Opportunities

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Structural composites are increasingly being used for commercial applications, especially in aerospace, automotive and civil structures industries. Challenges and opportunities exist from designing multi-phase composites, manufacturing to yield consistent products, characterizing their structural behavior, and building a predictive numerical model. A relatively new constitutive model has been implemented in LS-DYNA commercial computer program as MAT_213 that supports modeling of orthotropic composites using solid, thin shell, and thick shell finite elements. The behavior is divided into three sub-models - visco-elastic-visco-plastic deformation model, coupled and uncoupled damage model, and failure model with four failure criteria – Puck, Tsai-Wu, Generalized Tabulated, and Point Cloud. The presentation will cover (a) laboratory and virtual (multi-scale modeling) experimental methods to generate data for the model, (b) validation tests to show the predictive capabilities include impact application, and (c) recent extensions of the material model to cover modeling of Additive Manufactured parts and 3D printed concrete.

Low Velocity Crush Event
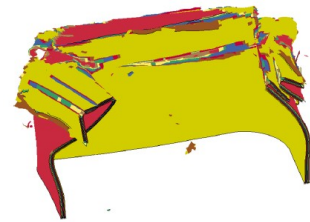
High Velocity Impact Event

Design of Soft Body Armor