Simulation Across the Automotive Supply Chain

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National experts in simulation as a decision-making tool for high-rate, high-performance composites supported by cutting-edge manufacturing and validation facilities.
Capture the Physics: Harness the Possibilities

Impregnation  Material  Molding  Performance  Crash  Assembly
Geometries

Lift Gate

Deck Lid

Double Dome
Material Form and Molding Simulation

Impregnation  Material  Molding  Performance  Crash  Assembly

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The Effect of Material Form (PPMC) on Performance Variability

Prepreg Material

Prepreg Tape

Prepreg Platelets (Molding Compound)

Transformed into Platelets

Uncontrolled Deposition & Compression Molding

Molded Composite

Orientation State

Platelet Geometry

Composite Morphology

Structure of a Composite System

Effective Properties & Variability
Key Descriptors for Performance

Platelet Aspect Ratio

Platelet Orientation

Platelet Aspect Ratio

Platelet Orientation

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Material Form by Design

- UD pre-impregnated tape
- Chopped strands (a.k.a. platelets/flakes/chips)

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Characterizing Initial Orientation

Orientation Measurement, Purdue CMSC
Double Dome: Validation Geometry
Double Dome Molding Simulation

Mat material form

charge width

charge length

form mat onto tooling surface

charge

tool

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Double Dome Flow Simulation

Degree of Longitudinal Alignment (Along 3-Direction)

Molding Simulation in Abaqus, Purdue CMSC
Flow Validation Against “Short Shots”

Purdue Molding Simulation “Snapshots”

Dow Molding Experiment “Short Shots”

Knit line prediction confirmed
Orientation Engineering through Charge Placement

Axial charge

Transverse charge
Toward Engineering Platelet Orientations

Legend: Degree of Collimation with Axis

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Transverse charge

Axial charge

$x_3$-direction extension gives high $a_{33}$

Orientation state remains primarily random
Full-Scale Lift Gate Molding Simulation
Simulation: the Language of Innovation Across the Automotive Supply Chain