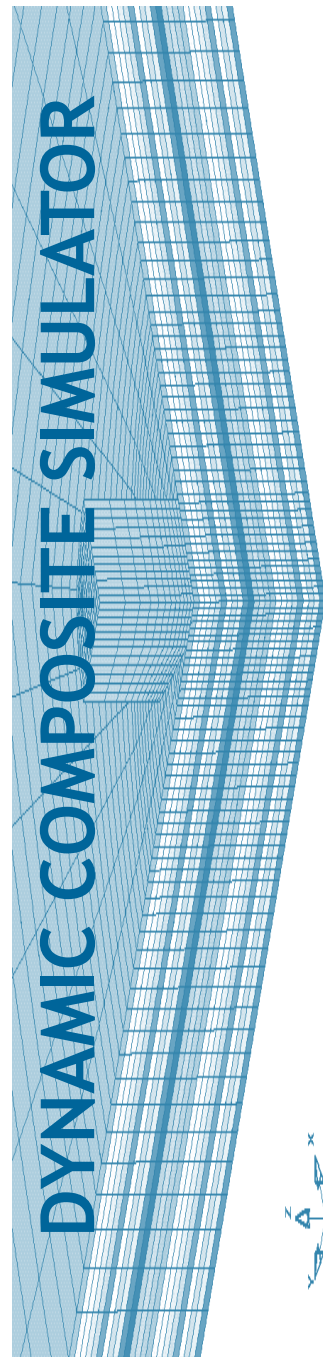




MSC/LS-DYNA Composite Software and Database

Materials Sciences Corporation (MSC) and Livermore Software Technology Corporation (LSTC) announce the **Dynamic Composite Simulator** module of LS-DYNA. This enhancement to LS-DYNA enables the most effective and accurate dynamic progressive failure modeling of composite structures currently available.

various fiber, matrix and interply delamination failure modes. Implementing this code will result in the ability to optimize the design of composite structures, with significantly improved survivability under various blast and ballistic threats.



MSC and LSTC have joined forces in developing this powerful composite dynamic analysis code. For the first time, users will have the enhanced ability to simulate explicit dynamic engineering problems for composite structures.

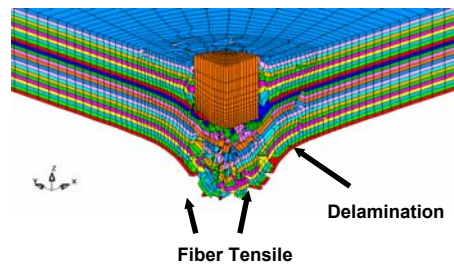


MSC's LS-DYNA module can be used to characterize a variety of composite structures in numerous applications—such as this composite hull under blast

The integration of this module, known as 'MAT 161', into LS-DYNA allows users to account for progressive damage of

CAPABILITIES

- Database of elastic/strength properties provides quick material selection of a wide spectrum of composite materials including Glass, Kevlar, and Carbon fiber reinforced composite plastic materials
- Composite progressive failure models integrated into LS-DYNA allow quickly performing difficult dynamic impact problems such as ballistic/blast impact, crash and drop weight
- Composite micromechanical models can be readily used to estimate elastic and strength properties for selected composite systems
- Applicable to shell and 3D elements
- Upgraded output capability for damage zones display
- Provides functionality of specifying initial damage parameters for residual strength evaluation



Penetration involving perforation behavior in composite armor

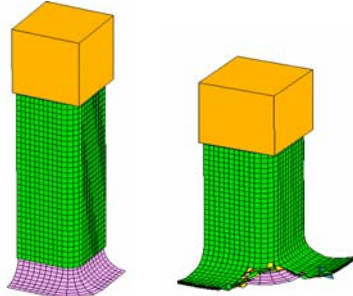
Wide Range of Impact Problems

- Low velocity impact
- Crush Analysis
- Penetration
- Blast loading
- High speed ballistic impact
- Crash impact

ADVANTAGES

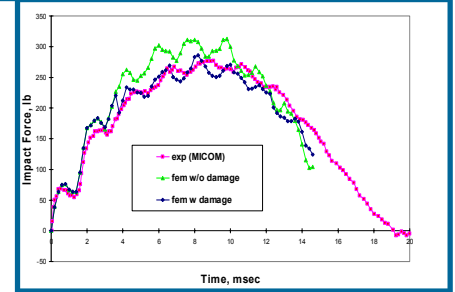
Leveraging industry-leading explicit dynamic analysis technology from LSTC and composite material modeling and characterization capabilities from MSC, the Dynamic Composite Simulator:

- Integrates best-in-class explicit dynamic analysis code LS-DYNA with the MSC composite progressive failure models

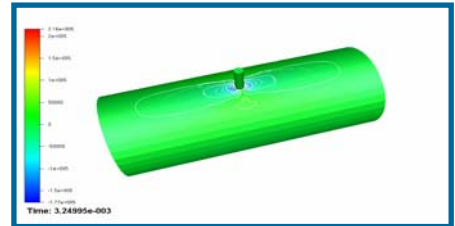


Simulation of Dynamic Crush of Square Composite Tube

- Enables fast, accurate and effective resolution of complicated dynamic engineering problems for composite structures
- Accounts for progressive damage of various fiber, matrix and interply delamination failure modes
- Includes material properties database for both unidirectional and fabric composite
- Improves post failure modeling by utilizing damage mechanics approach to reduce mesh sensitivity
- Identifies fiber breakage and delamination for each layer
- Provides accessibility of damage history and stresses in neighboring elements for damage progression modeling



- Results in accurate output, proven to correlate well to experimental tests.



Hoop Stress in AMCOM Tube Subjected to Low Impact Energy

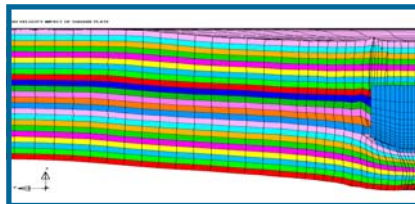
APPLICATIONS

This integrated software/database package can be used effectively to design various composite applications including:

- **Protection systems** such as composite armors of various levels of ballistic/blast protection, helmets for aviation and sports, blast barriers for buildings, blast resistant containers, etc.
- **Automobile parts** for crashworthiness capability such as car body, bumpers, girders, steering wheel and steering column.

- **Lightweight impact resistant containers and structures** such as rocket motor cases, pressure vessels, natural gas vehicle fuel tanks, and other containment structures.

- **Aerospace components** such as wing panels, launch vehicle components and satellite components.



Analysis results have been proven to correlate well to experimental tests – such as this glass/VE composite target subjected to impact

ABOUT MSC

The Materials Sciences Corporation (MSC) is an engineering organization providing advanced technology for the structures and materials field. We are specialists in understanding the relations between material properties and structural performance, and we are particularly well known for our expertise in the field of composite materials.

MSC is active in many aspects of the structures and materials field including analysis, design, research, applications, cost and marketing studies.

We conduct programs for clients covering a broad range of interests in government, industry and commerce. We also offer a wide range of products developed to study and characterize advanced materials and structures.

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