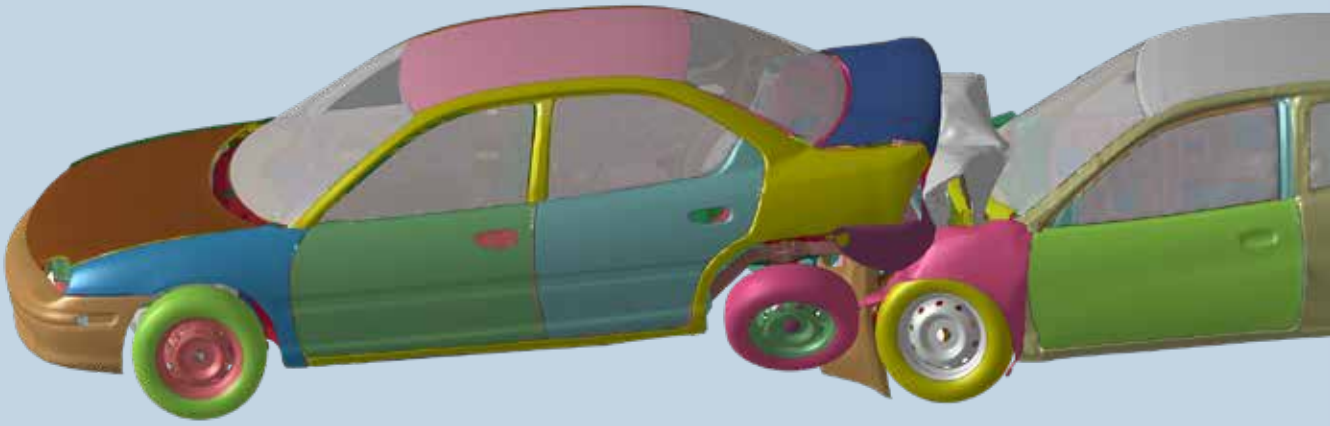


ANSYS Expands Access to Advanced Multiphysics Simulation with LSTC Acquisition

By **Siddarth Shah**, Principal Project Manager, Structures, ANSYS

By acquiring longtime partner Livermore Software Technology Corporation (LSTC), ANSYS can more deeply integrate LS-DYNA's explicit dynamics solver to make it easier for engineers with different skill sets to solve short-duration events. The code's origins lie in highly nonlinear, transient dynamic finite element analysis (FEA) using explicit time integration, such as those that occur during automobile crashes, bird strikes on aircraft and explosions. The pairing of the ANSYS and LS-DYNA solvers creates a solution that helps engineers understand the elaborate combination of nonlinear phenomena found in such events.

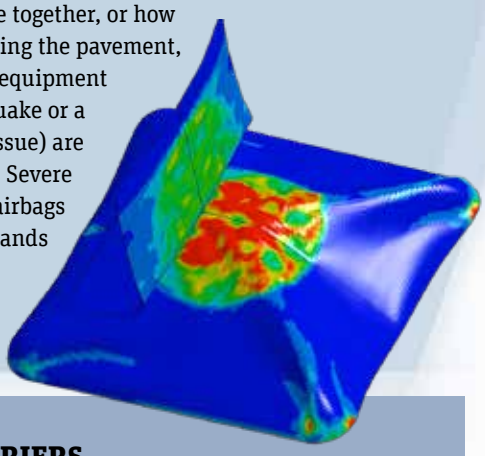
With a focus on speed and accuracy, LS-DYNA, the LSTC flagship product, has been the gold standard in the automotive industry for crashworthiness and occupant safety simulation for decades. LSTC estimates that LS-DYNA is the primary crash analysis tool for over 80% of the world's major automotive manufacturers, and that the code is used by 90% of tier 1 suppliers. It excels at simulating the response of materials subject to short periods of severe loading, such as those that occur during crashes, drops and even metal forming.

ANSYS customers have benefited from the combined strengths of ANSYS Mechanical and LS-DYNA since ANSYS LS-DYNA was first released in 1996. Integration of LS-DYNA with ANSYS Workbench in 2013 made it easy for engineers of different experience levels to perform LS-DYNA simulations using the familiar Workbench user interface.

The combination of ANSYS Workbench and LS-DYNA has helped explicit dynamics simulation expand beyond experts with specialized domain knowledge. At the same time, access to the computational power needed to perform multiphysics simulations has become more affordable, allowing LS-DYNA's scalability to shine on models with higher and higher degrees of freedom.

MULTIPLE DOMAINS, PARTS AND PHYSICS IN ONE SOLUTION

Engineers of all types now use ANSYS LS-DYNA to study product behavior via simulations involving severe material deformation or failure. The software makes it easy to study the interaction between parts, enabling users to easily evaluate how parts and assemblies behave together, or how the product behaves as part of a larger system. A bike helmet striking the pavement, a turbine engine containing fragments of a broken blade, defense equipment reacting to a blast, a hydroelectric dam being rocked by an earthquake or a server crashing to the floor (as IBM illustrates on page 14 of this issue) are all examples of interactions that have been studied with LS-DYNA. Severe material deformation behavior could be related to anything from airbags deploying to metal bending during hydroforming. There are thousands of such short-duration events and contacts that could be analyzed using ANSYS LS-DYNA.



ANSYS LS-DYNA can simulate explicit events, such as delamination. >

CRASHING THROUGH BARRIERS

When John Hallquist began developing a solver with explicit time integration to study nonlinear dynamic problems while working at Lawrence Livermore National Laboratory in 1976, he couldn't have predicted its evolution into LS-DYNA, the flagship of LSTC, which he founded in 1987. Over the years, LS-DYNA's functionality has been expanded. Below are just a few examples of the different analyses and methods LS-DYNA supports.

- **Arbitrary Lagrangian Eulerian Method**
- **Incompressible Computational Fluid Dynamics**
- **Conservation Element/Solution Compressible Fluids**
- **Discrete Element Method**
- **Electromagnetism**
- **Element-Free Galerkin Method**
- **Fluid–Structure Interaction**
- **Implicit Simulations**
- **Noise, Vibration and Harshness**
- **Smooth Particle Hydrodynamics**
- **Thermal Transfer**

In addition to the interaction of parts, ANSYS LS-DYNA also features lesser known but powerful capabilities to solve strongly coupled multiphysics problems that cannot readily be evaluated by physical testing. The software's explicit and implicit time stepping makes it possible to simulate static and dynamic tests with the same model. Simulations such as these are possible thanks to the ability of the LS-DYNA solver to handle multistage, multiscale, multiphysics problems with one solver: the internal shorting behavior of an electric vehicle battery; the noise, vibration and harshness (NVH) of a golf club hitting a ball; the splashing and hydroplaning behavior of a car tire driving through a pool of water or even the complex behavior of an aortic artificial heart valve opening and closing as blood pumps through it.

Viewing a rendered LS-DYNA crash simulation from below. *Rendering courtesy of Ed Helwig.*

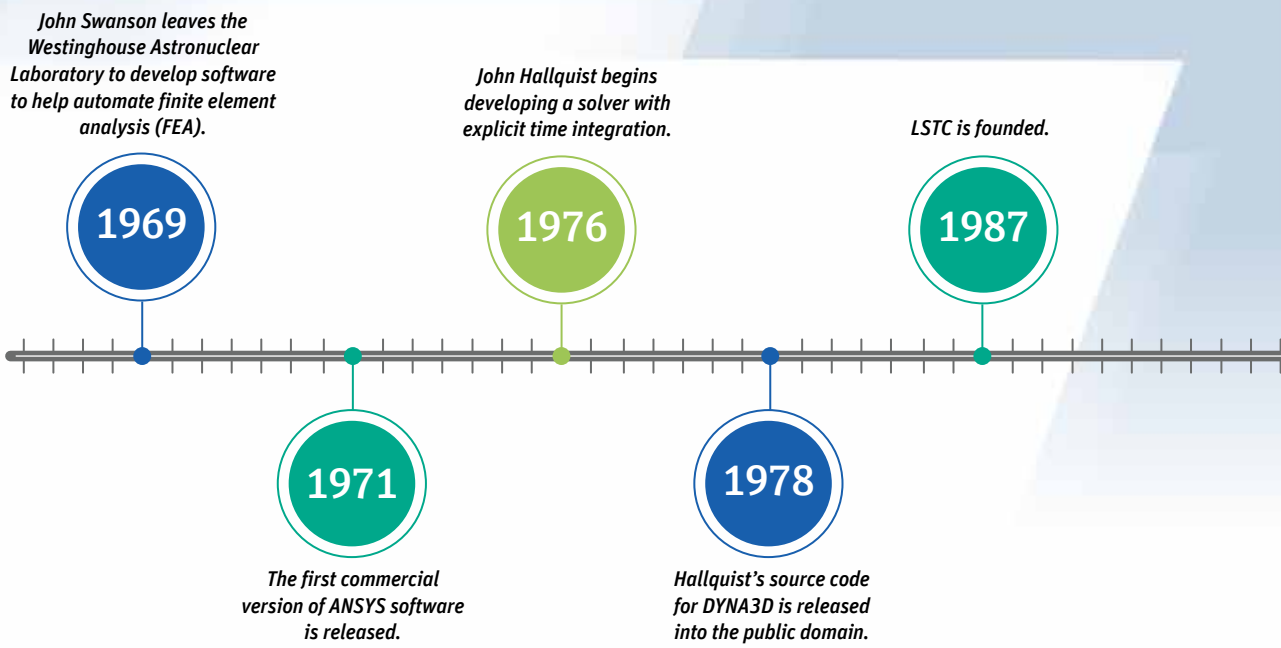
The left side of a vehicle after crash testing. Simulation can be used to minimize the number of physical tests needed. *Image courtesy of National Highway Traffic Safety Administration.*

BETTER TOGETHER

The unified ANSYS LS-DYNA solution delivers the pre-processing and post-processing tools available in the ANSYS Mechanical environment — including automated meshing and the ability to define material, contact, and loads and boundary conditions. Engineers can perform parametric studies on CAD geometries that are ready for explicit analyses without leaving the intuitive ANSYS Workbench environment. ANSYS LS-DYNA Workbench users can access ANSYS SpaceClaim for geometry modeling, as well as bidirectional computer-aided design (CAD) connectivity.

ANSYS LS-DYNA provides a wide range of accurate low- and high-order element formulations in solids, shells and beams. These can be applied on a per-part basis through the ANSYS Mechanical interface, so engineers can place high-fidelity elements only in the areas where they are necessary to save time. Contact can be automatically detected between separate parts, within parts and within individual elements.

Engineers and simulation analysts using ANSYS Mechanical and LS-DYNA find that the Workbench integration can decrease their time to solution. Part of that speed increase stems from LS-DYNA's parallel calculations that can scale from desktop computers to clusters of thousands of processors using Linux, Windows and UNIX. ANSYS LS-DYNA users also benefit from the workflow efficiencies and ease of use inherent in ANSYS Mechanical.



MORE TO EXPLORE

With the acquisition of LSTC by ANSYS, customers of both companies can look forward to even deeper integration of technologies that provide the best of both worlds. The goal of the acquisition is to help our customers meet the challenges of engineering the complex systems of today and tomorrow, such as those in autonomous and electric vehicles.

"Leading companies in every industry are using simulation to develop more-complex products, faster and at lower cost than ever before," says Ajei Gopal, ANSYS president and CEO. "To meet those challenging market demands, our customers need best-in-class solutions that enable them to innovate at the speed of thought."

Deeper integration between LS-DYNA and ANSYS Workbench will help optimize the multiphysics product design and development workflows needed to capitalize on disruptive technologies such as electrification, autonomous vehicles and 5G as they continue to spread beyond automotive, aerospace and telecommunications into virtually every industry. Bigger, more complicated problems require faster, more accessible solutions — and that's what ANSYS is providing its customers with the acquisition of LSTC.

As ANSYS tightens the integration of LS-DYNA into Workbench, customers can be assured that they will be at the heart of the company's decision-making processes.

"I expect that the combination of Workbench and LS-DYNA will expand our user base by at least an order of magnitude," says John O. Hallquist, founder of LSTC. "Here at LSTC, nothing makes all of us happier than when our research enables more customers to imagine, design and implement ambitious projects that were previously impossible."

LS-DYNA Applications

Automotive
Crash & Occupant Safety
NVH & Durbility
Battery Reliability

Aerospace
Bird Strike
Blade-off Containment
Crash

Manufacturing
Forming
Stamping
Machining

Consumer Products
Packing
Switches

Civil Engineering
Blast Proofing
Earthquake Safety
Tents

Electronics/Hi-Tech
Drop Analysis
Package

Defense
Projectiles and Weapons
Blast and Penetration
Underwater Shock Analysis

Bio-Medical
Devices & Equipment
Medical procedures