

BROCHURE /

Ansys Explicit Dynamics



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Ansys Explicit Dynamics Takes Over When Implicit Isn't Enough

For specialized applications, Ansys offers the split-second insight you need along with ease of use and trusted results.

If your product needs to survive impacts or short-duration high-pressure loadings, you can improve its design with Ansys® explicit dynamics. Specialized problems require advanced analysis tools to accurately predict the effect of design considerations on product or process behavior. Gaining insight into such a complex reality is especially important when it is too expensive — or impossible — to perform physical testing.

The Ansys explicit dynamics suite enables you to capture the physics of shortduration events for products that undergo highly nonlinear, transient dynamic forces. Our specialized, accurate and easy-to-use tools have been designed to maximize user productivity.

With Ansys, you can gain insight into how a structure responds when subjected to severe loadings. Algorithms based on first principles accurately predict complex responses, such as large material deformations and failure, interactions between bodies, and fluids with rapidly changing surfaces.

An extension of our structural mechanics suite, explicit dynamics software shares the same graphical user interface (GUI), serving mechanical engineers who need to study highly complex problems, especially ones with high strain rates and other complications that are difficult to solve with general-purpose implicit solution methods.

A short learning curve is a hallmark of our products. The GUI speaks the language of the engineer or scientist. Consequently, the software's internal complexity is hidden from view, even as sophisticated, state-of-the-art mathematical algorithms resolve problems.

Defaults are safe and reasonable values for most options, which means that you spend less time setting up and running problems and more time optimizing products for performance, durability and cost, as well as removing design flaws.

In many cases, the accuracy of an explicit solution can be verified only via comparison with physical experiments. For some problems (such as explosions), it may be too expensive or impossible to perform tests. Yet Ansys users around the world rely on the accuracy of explicit results; an extensive list of publications is testament to the correctness of our algorithms and models. "Ansys explicit dynamics repeatedly enables us to solve complex explicit problems for our customers. We can get answers to them quickly due to the program's ease of use. The state-of-the-art solution methods and extensive material models produce accurate results, a necessity for creating follow-on business."

Chris LeBoeuf Principal Engineer / ABS Consulting



Sheffield Hallam University used our explicit solution to simulate ball-on-tennis-racket impacts. Their research centered on the coefficient of friction between strings and ball, and the position of the racket's balance point. The value of physical testing is limited in evaluating these potential improvements because of the high cost and time involved in building the huge number of new designs that need to be evaluated.



Ansys explicit dynamics tools help engineers to explore a wide range of challenges:

- Short-duration, complex or changing-body interactions (contact).
- Quasi-static.
- High-speed and hypervelocity impacts.
- Severe loadings resulting in large material deformation.
- Material failure.
- Material fragmentation.
- Penetration mechanics.
- Space debris impact (hypervelocity).
- Sports equipment design.
- Manufacturing processes with nonlinear plastic response.
- Drop-test simulation.
- Explosive loading.
- Explosive forming.
- Blast-structure interactions.



Ansys explicit dynamics tools help users meet solution requirements of various complexities based on problem details and user expertise.

Ansys Mechanical™

Ansys Explicit STR™

Broad spectrum of capabilities covering range of analysis types

Entry level; well suited for designers and Mechanical users who need to solve highly nonlinear problems requiring explicit solutions

Ansys LS-DYNA®

General purpose with extensive capabilities; best suited for expert analysts and researchers

Ansys Autodyn®

Easy to use for multiphysics and sophisticated material response; well suited for designers and analysts who use Ansys Workbench™ to easily solve complex realities









Wire crimping, a complex contact problem.

Deformation of constant velocity boot.

Failure of window crank mechanism, modeling material failure under dynamic loading.

Blade-off containment demonstrating failure of bonded connection and subsequent complex body interactions (contact).

/ Almost Any Severe Application Can Benefit From the Embedded Deep Physics in Our Explicit Suite

With Ansys explicit dynamics products, you get a comprehensive set of advanced tools to help gain insight into virtually any event that can be simulated.

For example, the FE (Lagrange) solver is the most commonly used and the computationally fastest method to represent structures. It is best suited for tracking shock waves and peak pressures. Within each element, Lagrange captures the material location of the discretized model and follows its deformation as forces are applied, resulting in distorted elements.

The Euler method follows the flow of materials throughout a region represented by a fixed mesh. It is ideal for modeling severe deformations of solids as well as the flow of liquids and gases. With the Ansys virtual Euler solver, the mesh is generated automatically without any user input.

Arbitrary Lagrange–Euler (ALE) combines the advantages of Lagrange and Euler while eliminating some of their shortcomings. It is ideal for simulating materials with severe deformations in which high-resolution shock response is desirable.

Smooth particle hydrodynamics (SPH) is a mesh-free method best suited for problems involving material separation, such as hypervelocity impacts or crack propagation in brittle materials.

You can combine Lagrange, Euler, ALE and SPH in a single problem to produce the most efficient and highest accuracy results possible.



"The ability to couple Eulerian and Lagrangian frames of reference is especially helpful in blast field modeling. With Ansys explicit dynamics, energy is easily transferred between the two for accurate modeling of the entire blast process."

Dale Preece

Global Technology Development / Orica USA Inc.



Water jet impacting surface.



A critical requirement for efficient and accurate explicit analysis is a high-quality mesh. Our explicit products benefit from integration in the Ansys Workbench environment, which includes powerful automatic mesh generation. You can create high-quality hex (brick) elements for more complex geometries using multi-zone meshing, a standard tool within Workbench that automatically decomposes more complex geometries into parts that can be swept to create hex elements.

Some geometries, especially those created for manufacturing and imported from CAD data, are too complex to be swept to produce a full hex mesh. Tetrahedral (tet) elements can accurately represent small portions of a part's geometry that cannot be swept. An Ansys explicit special tet-element formulation called nodal-based strain (NBS) eliminates shear locking, a problem encountered with traditional tet elements. Accurate tet elements make it easier to create working meshes that can represent complicated geometries.



Automatic body-by-body meshing for analyzing cell phone assembly via explicit drop testing.



Cell phone with solder connection submodel.





Virtual prototyping, from CAD to blow molding to drop-test analysis.

Sports equipment design using composite materials.



Additional complexities with material response are enhanced with tools that enable fluid-structure interaction (FSI). Examples include a high-speed projectile moving though a liquid (shown here) or movement of a structure from a blast wave.





High-quality mesh generated in Ansys Workbench using automatic multi-zone method.



/ Our Single Resource Offers Clarity and Insight Into Your Advanced Technology Needs

Ansys explicit dynamics tools are one part of our suite that delivers cutting-edge functionality — depth, breadth, a plethora of advanced capabilities and integrated multiphysics — providing confidence that your simulation results reflect real-world outcomes. The comprehensive range of solutions provides access to virtually any field of engineering simulation that a design process requires. Organizations around the world trust Ansys to help them realize their product promises.

Productive Environment

The interface for our tools, Ansys Workbench, enables users to model all applications, from very simple to very complex. The platform can take weeks, sometimes months, out of a CAE process by eliminating manual file transfer, results translation and errors that often come from manual data entry. Workbench eliminates the labor required to produce updated simulation results brought about by design changes. It includes an extensive material library and automatic meshing, which further reduce problem set up effort and time.





Eletronuclear S.A. used Ansys explicit dynamics tools to simulate a hypothetical explosion near a nuclear power plant. The initial stage was simulated with the multi-material fluid (Euler) solver, as different types of materials can all be modeled in the same region. The Euler FCT solver came into play after the explosion, as it simulates the response of ideal gases with second-order accuracy very quickly.

Advanced Study

Modern CAD tools create geometries that are real-life accurate. Because most CAD geometry models are created for manufacturing purposes (but not for analysis), they often include overlapping surfaces, gaps and other dirty forms. Ansys pre-processing tools clean, correct and reduce CAD complexity, making it possible to increase accuracy and speed.

Explicit dynamics accuracy is, in part, a function of element size. Generally, the smaller the elements, the more accurate the results — but this requires longer compute times. Ansys HPC techniques allow you to improve accuracy as well as to examine multiple designs in a given time. Reducing elapsed time for calculation leads to better, more optimized products. The end result is confidence that your product will thrive in the real world.

Design Analysis and Optimization

To understand a design's performance, you must identify the effect of all design parameters — which can easily lead to meeting product requirements. Ansys DesignXplorer[™] provides in-depth product understanding, illustrating the relationship between design variables and product performance — all before building a single prototype.

Managing Simulation Data

Simulation engineers — especially those performing explicit dynamics analyses — generate large volumes of data that need to be archived in a searchable format. Ansys Engineering Knowledge Manager[™] (EKM) enables capture and management of simulation data along with workflows and best practices. The tool can improve simulation efficiency and productivity.



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ANSYS, Inc.

Southpointe 2600 Ansys Drive Canonsburg, PA 15317 U.S.A. 724.746.3304 ansysinfo@ansys.com If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where Ansys software played a critical role in its creation. Ansys is the global leader in engineering simulation. We help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and engineer products limited only by imagination.

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