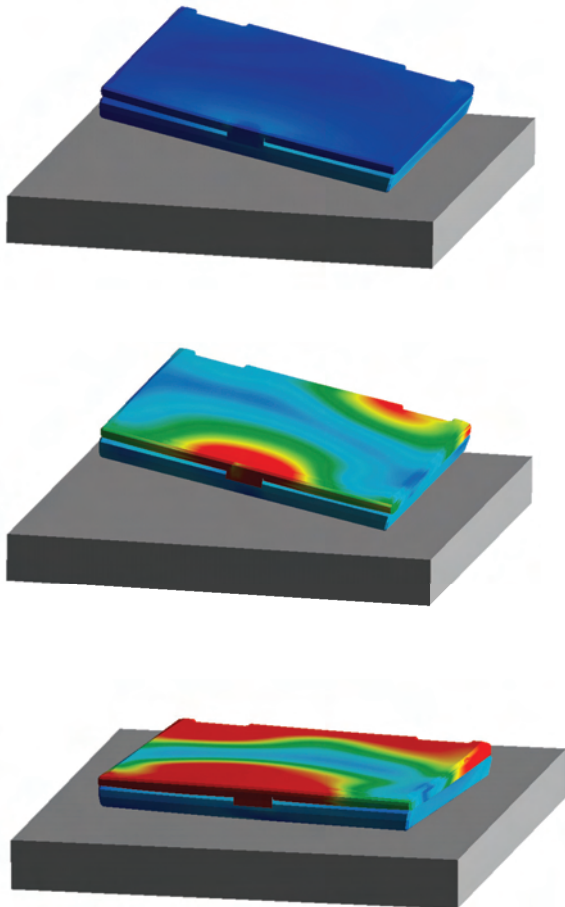


NEi Nastran Automated Impact Analysis (AIA™) and Drop Test

Application of Impact Analysis in Industry

Impact analysis is an important consideration for a wide variety of product development projects from drop testing portable electronic products like laptop computers to assessing product packaging effectiveness. Automated Impact Analysis (AIA™) is an exceptional simulation tool because it makes a complex analysis easy to do while retaining the complexity of the underlying physical phenomena that are present in impacts. The input is simple -- define projectile initial velocity and acceleration. Complexity is handled by NEi Nastran solvers as they automatically setup surface contact between the projectile and part, determine the contact surface between the two, calculate the contact duration and time steps needed to capture an accurate nonlinear transient event, and determine the vibration characteristics of the colliding bodies. NEi Nastran AIA can provide a thorough and physically realistic simulation of impact because it takes into account surface contact, time duration of impact, and the vibration characteristics of the colliding bodies. This is much more comprehensive and useful than a simplistic imposition of force at a point found in other impact or drop tests.

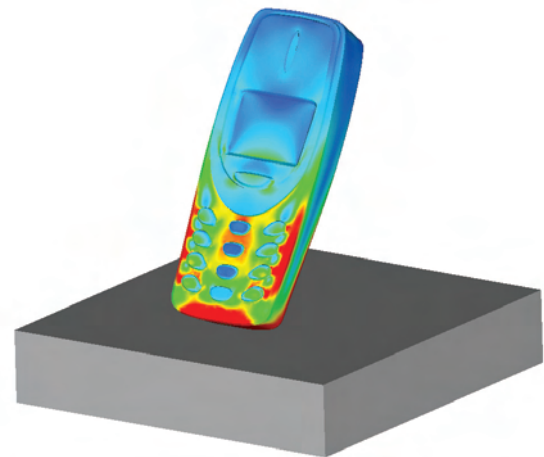


Automated Impact Analysis (AIA) can also be used as a virtual Drop Test. Example shown is for a laptop computer.

Benefits of Impact Analysis

Product development engineers can realize the following benefits applying impact analysis software:

- Detailed insight into the dynamic implicit nonlinear behavior of real world impact problems and product drop testing.
- Improve design quality by exploring the effects of design changes.
- Optimize the structural performance of products and assure they meet safety, regulatory, warranty and customer satisfaction requirements.
- Many consumer products with highly compressed design cycles, for example consumer electronic products, can realize faster time to market. Impact analysis helps by validating concepts early in the design cycle, reducing the number of prototypes required, eliminating the amount of physical testing that must be done, and avoiding time consuming redesigns.



Elements of an Impact Analysis

Projectile and Target - Projectile and target can be arbitrary shapes. The material of each object is specified.

Initial Velocity and Acceleration - The ability to specify the initial velocity and acceleration of the projectile provides flexibility for varying test conditions. The impact velocity is calculated.

Orientation of the projectile - The actual orientation of the object when it strikes the target is typically quite important. Each orientation can yield significantly different key results.

Contact Definition - The object is positioned at the point in space where it would be dropped from, with the appropriate orientation. The target is positioned and the user defines the path the dropped object can travel along.

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How it Works

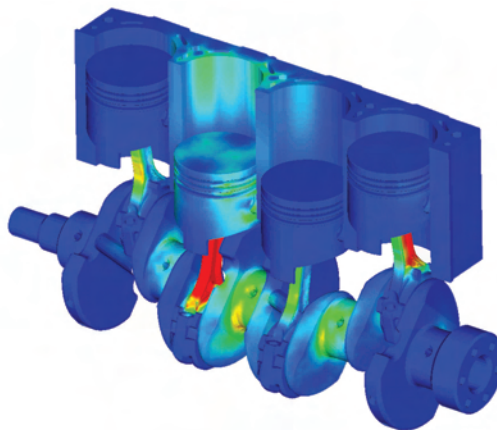
Drop Distance and Final Velocity - NEi Nastran AIA will calculate the distance the object will travel up to the point where contact is made, automatically repositioning the projectile.

Automatic Surface Contact Generation - NEi Nastran AIA seeks contacting mesh surfaces and creates contact between the two bodies.

Vibration Characteristics - The natural frequencies of both the dropped object and the target are assessed at the point where they are just in contact and the dominant frequencies are identified.

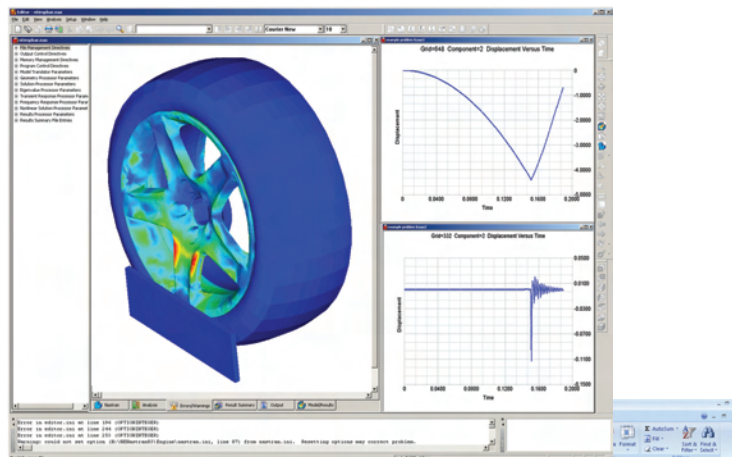
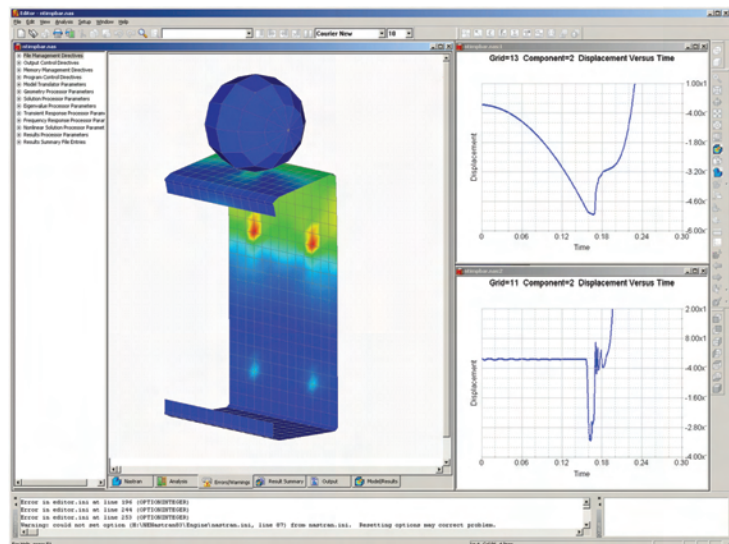
Impact Duration and Time Steps - Both the impact duration and the time step can be assessed from the characteristic mode being excited in the impact.

User Input - Define the starting position of the projectile or drop object, the initial velocity, and the acceleration.



Post Processing Functions available in the Editor

- Maximum displacements, stresses, etc. can be tracked as a function of loading
- View results real-time as they change for each load increment or time step
- Change nonlinear parameters real-time
- Generate x-y plots real-time and store as MS Excel Comma Separated Variable (.CSV) files
- Generate multiple plots with a single command
- Custom x-y plotting of results



Impact Analysis Using the Nonlinear Transient Solver

Automated impact analysis is one feature of the nonlinear transient solver in NEi Nastran. Using this solver, impact can also be set up manually for more control over the variables. Also, nonlinear events other than impact can be modeled, such as, post-buckling behavior and impact event sequences.

