Success Story

Panasonic Ecology Systems Shortens Development Time of Indoor Air Quality Products by Applying Virtual Product Validation with HyperWorks

Key Highlights

Industry
Electronics

Challenge
Make product drop tests more reliable

Altair Solution
Perform product drop test analysis in each style

Benefits
- Reduce development and manufacturing cost
- Shorten design and development cycle
- Produce higher quality product

Customer Profile

Panasonic Ecology Systems Co,. Ltd. is one of the companies under Eco Solutions Company of Panasonic Corporation. Among Panasonic Group, we play a key role for the sales of Indoor Air Quality (IAQ) products and solutions globally, in order to realize the vision of providing comfortable living space for people around the world while reducing the impact on the environment.

The Challenge: Reliable Drop Tests

“Drop tests of prototypes produce unreliable, inaccurate results, because the materials from which they are made usually differ from those of mass-produced products,” explains Hironari Ogata TITLE, “while drop tests of mass production trial products may lead to costly die modifications.”

Ogata understood that evaluating designs through drop-testing before completing them can reduce losses, and called on RADIOSS, a leading structural analysis solver for highly non-linear problems under dynamic loadings such as impact analysis. A key component of Altair’s HyperWorks suite of computer-aided engineering tools, RADIOSS was already part of the CAE suite Panasonic had been using for other structural analyses. “This makes effective use of dormant resources,” he points out, “eliminating the need for new investment, and this analysis could be applied to product development in other product fields.”

The Solution: A Multi-step Testing Plan

Ogata’s team developed a multi-step plan to analyze a product in each stage of its development. They began by drop-testing a single component, then moved on to a combination of several components, an assembled product and a packaged product. At each step, the team employed Altair’s RADIOSS solver to calculate the drop-test impact.

Keywords: Panasonic, HyperWorks, RADIOSS, HyperMesh, HyperView

Panasonic Success Story

“RADIOSS enables easy definitions of contact between components, and it simulates reality well.”

Hironari Ogata
Panasonic Ecology Systems Co,. Ltd.
IAQ Business Unit Concurrent Development Team

Results: Faster Time to Market

Single component

At level one, the team investigated drop analysis for a single component, for example, setting up a drop-test of the front panel of a ventilator installed on a ceiling, such as a bathroom ventilator dryer. This component can be removed during maintenance and may be subject to falling. The panel, measuring 500 mm. on each side, was made of ABS resin and was dropped from a height of 1 meter.

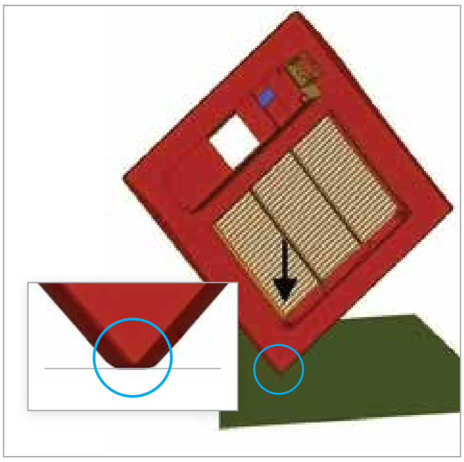
A model of the front panel meshed with HyperMesh was placed in the space directly above a hard floor, and the simulation condition was a drop in which a panel corner hit the floor. Engineers used HyperView to observe the results as animated pictures showing the fall, collision and deformation sequence for the panel.

HyperView showed that, upon impact, the corner deformed first, after which the entire front panel deformed in a rhombus shape. The explicit method of analysis showed that the largest stress was generated at the corner, and the next most significant stress was at the filter grid. The engineering team modified the panel thickness and shape in several regions, and the resulting model was used in the product design, reducing die-related losses and shortening the design period.

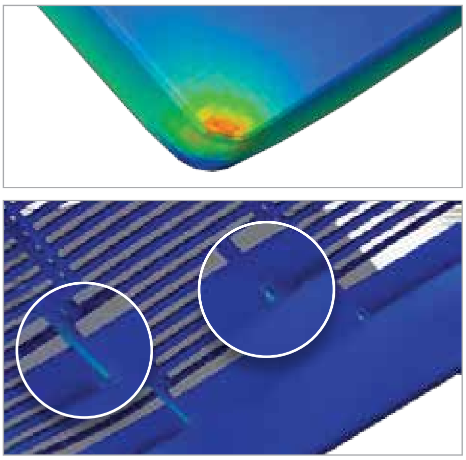
Component with attachments

In the second set of tests, the team analyzed the front panel with its two wire attachments and two 20 cm.–long wires that were designed to prevent it from falling off. “The strength of the wire attachment was important,” Ogata noted, “because this preventive measure is meaningless if the attachments break from the shock when the wires stretch after the panel drops.”

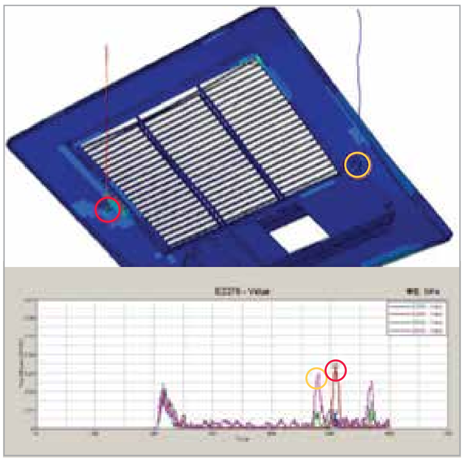
After the drop test, HyperView again displayed the analysis results as animated pictures, and a graph showing the change in stress over time for a fixed point revealed that the panel made a full swing as the wires



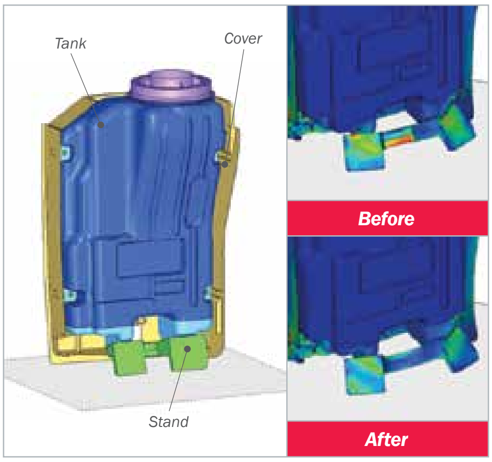
Drop analysis performed on the front panel of a ceiling-mounted ventilator



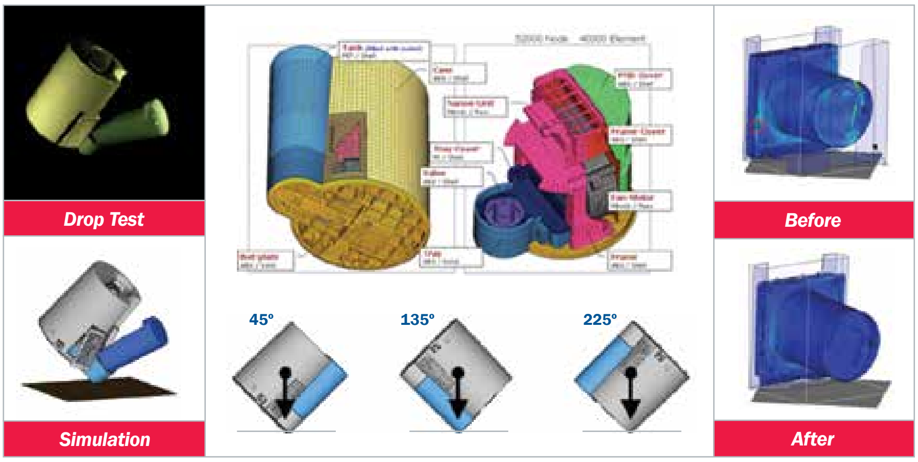
Simulation shows high concentration of von Mises stresses on the grid corners



Front panel simulated with its two wire attachements



Left: Model of tank with stands and cover
Right: Stress results comparison



Left: Simulation correlates well with physical test results
Center: FE model of a tabletop humidifier and Analysis setup with different drop angles
Right: Simulation also helped in redesigning the fan packaging

stretched to their full length, followed by the maximum stress generated when the wires stretched a second time. The team investigated the panel's shape, location and number of attachments to reduce the stress and applied the results to the design to accelerate the design period and reduce trial reduction costs.

Combination of several components
Another example of analysis performed on more complex assemblies is a water tank of a humidifying air cleaner, which represents a combination of several components, with connections and contact between the components. An ABS cover was attached along the tank axis and fixed with screws to the tank so that polypropylene foot-like stands could turn by their own weight when the tank was being filled with water.

With the tank completely filled to avoid sloshing issues, fall heights for the test were set at 1 meter and 0.6 meters to simulate a drop from carrying the tank at hand height and at 0.1 meters to simulate the tank's being set down.

Analysis found that the impact from a 1 meter fall disconnected the stands. At 0.1 meters, the stands almost disconnected. Engineers modified the shape of the stands to prevent disconnection and damage and then applied the simulation results to the design to shorten the evaluation period and again reduce trial production costs.

Assembled product
An even further complex analysis can be performed on a complete and assembled product, such as a tabletop humidifier made from many components. The fall height was 80 cm., which is specified in the testing standard, and the humidifier was dropped several times at angles of 45°, 135° and 225°. In the 45° drop, maximum stress appeared at a hole that connects a plate with the frame. At 135°, the tank fixing gripper on the case generated a large amount of stress. The team modified the gripper shape and found ways to decrease the thickness and weights of components, then used those results to cut evaluation time, trial production and material costs.

Furthermore, a high-speed movie of the drop tests with a mass-production trial product compared extremely well with an animation produced by the simulation, both showing the tank popping up and the filter cover flying away.

Packaged product
The final stage of Panasonic's virtual prototyping process is to analyze a packaged product, with drop tests that involved both the product and packaging materials. In this example, the cube, with 250 mm. sides, and most components were made of resin, and the packaging material was cardboard. With the product dropped from 80 cm., analysis was carried out repeatedly by varying the coefficient of elasticity of the buffer material until the same impact acceleration as the physical test was obtained.

The analysis indicated that the initial layout of the buffer material may lead to contact between components, causing them to break. The team discovered that, by eliminating the portion of the packaging that supports a duct, damage could be prevented. A physical test on the product produced similar damage for the initial layout, and the company began mass production without the offending section of buffer material. Analysis and modification reduced costs for both the product and packaging material and sped the product to market.

"By improving our technique at each development stage, we achieved our aim of a level of technology that enables drop impact analysis on packaged products," says Ogata.

Since the original tests in 2010, the company has used drop-impact analysis often in its product development, relying on Altair HyperWorks. "RADIOSS enables easy definitions of contact between components, and it simulates reality well," Ogata reports. "In addition, updated HyperMesh technology provides improved operability in modeling. These features have been used to good advantage in recent times, and analysis technology has been actively used in design processes that are difficult for 3D CAD, such as determining joint strengths of components. We will further improve our analysis technology to expand the field of virtual investigation and evaluation by employing HyperWorks."

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