HyperWorks Optimization Capabilities Integrated into Packaging Design Process Help Unilever Cut Costs and Development Time

Unilever

Key Highlights

Industry
Packaging Design

Challenge
Discover potential packaging issues early

Altair Solution
Meshing Automation and Optimization with HyperWorks

Benefits
- Cost Savings
- Shorter Simulation Schedules
- High accuracy

Customer Profile

Developing consumer products for more than 120 years, Unilever has become one of the world's most well-known companies. The company aims to "meet everyday needs for nutrition, hygiene and personal care with brands that help people feel good, look good and get more out of life." Today, Unilever produces more than 400 brands focused on health and wellbeing, from food to soap, and other household care products. Unilever's Global Packaging Design Group, based in Trumbull, Conn., develops hard-plastic containers for such brands as Dove, Suave, Caress, Axe, Degree, Ponds, Lux and other hair care, skin and deodorant products. The group works with outside design agencies to develop package concepts and then brings those ideas into a 3D modeling environment to ensure that the initial designs are able to be manufactured.

The Challenge: Early Discovery of Potential Issues

The Global Packaging Design Group attempts to discover any potential issues early in the design process. If problems are discovered after manufacturing has begun, the impact can be very costly, sometimes requiring modifications in the tools used during production. As a result, the design process can be time-consuming as designers seek to consider a wide range of possible issues.

The group, therefore, uses simulation to validate potential designs and to make certain the designs can be produced. One approach the group considered was outsourcing the simulation work, which would require an average of two months to develop and carry out the appropriate testing.

Keywords: Unilever, Package Design, HyperWorks, HyperStudy, OptiStruct, RADIOSS

Unilever Success Story

“HyperWorks is so integrated into our ways of working that it’s hard to picture our process of creating designs without it. If we didn’t have it, our jobs would be much harder, and there would be a lot more guesswork involved without substance to back it up and solve so many of the potential issues we analyze.”

Bill Maffeo,
Senior Design Engineer
Unilever Global Packaging Design Group

The Solution: Meshing Automation and Optimization with HyperWorks

Unilever reduced the time required for simulation and significantly lowered costs by working with Altair HyperWorks suite of computer-aided engineering tools.
“We have used HyperWorks in various ways,” said Unilever Senior Design Engineer Bill Maffeo, “and also have worked with Altair to make a more customized package that allows us to automate many of the typical simulation steps, shaving the time required for preproduction work.”

With HyperWorks, Unilever has been able to automate the meshing process, as well as the set-up of loads and boundary constraints. The designer now can input CAD-based models and simply select a prepared set of parameters.

The Unilever Packaging Design Group considers three main categories of potential issues when conducting simulations:

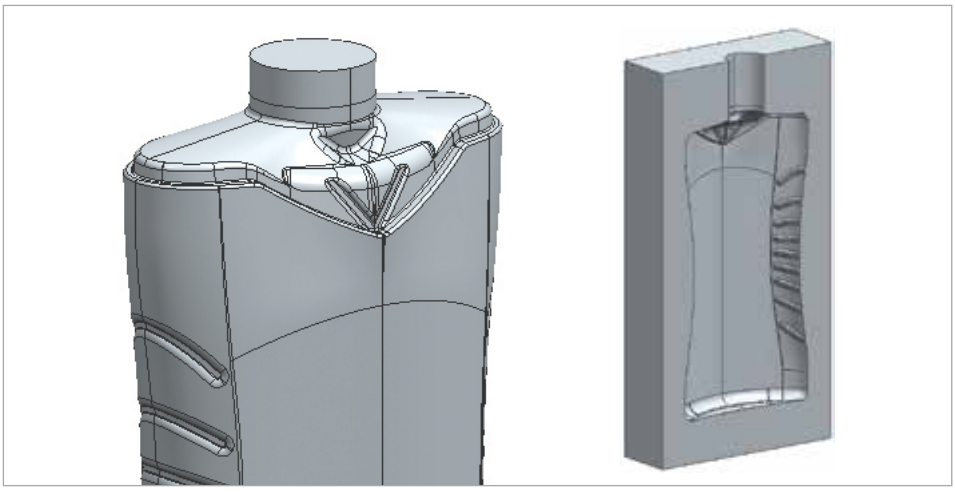
- Process issues, relating to extrusion blow-molding, injection blow-molding and injection stretch blow-molding
- Supply chain issues, focused on top-load crush tests, drop testing, cap insertion forces (exerted by the machine that pushes caps on bottles), paneling (twisting on assembly line) and tip angles
- Consumer issues, such as the strength required to squeeze the container, ability of the container to maintain its shape and the required cap-opening force

“We use simulation for every one of these tests,” Maffeo said, “and HyperWorks has been a very valuable tool.”

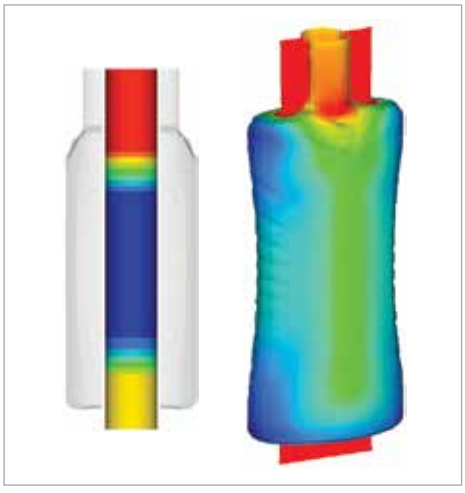
In a typical simulation, Unilever will begin with a CAD model of a plastic bottle that designers want to analyze.

They then develop a CAD model of the blow-mold tool from which the bottle will be created. A parison (tube of plastic) is created with the appropriate material properties, and the designers apply wall-thickness values to it by simulating the parison on the blow-mold machine. Designers subsequently perform a top-load crush test on the bottle using the wall thickness values from the blow-mold simulation. The test indicates if the bottle can hold the required top load for that particular design before the bottle deflects more than is allowed.

In addition to using HyperMesh to manage the meshing process for such analyses, Unilever also uses other HyperWorks tools, including the RADIOSS solver, HyperStudy and OptiStruct for topology and topography optimization. One goal of Unilever’s Packaging Design Group is to



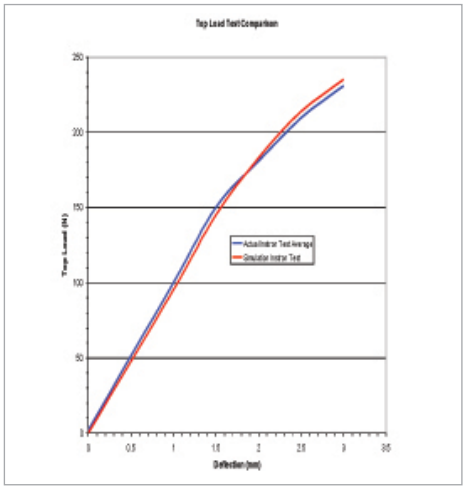
CAD models of bottle and blow mold



Blow mold Simulation mimicking wall thickness on actual 22g bottle

Instron Top Load Test showing deformation of actual 22g bottle

Top Load Simulation showing wall thickness and deformation of 22g bottle



Comparison of Force vs. Deflection Curve of Actual Top Load Test vs. Simulation

ensure that new designs use less material and are more optimized than the ones they are replacing, without compromising their structure, and OptiStruct plays a key role in helping to meet that objective.

For example, in creating a large container for Hellman's® mayonnaise, designers simulated blowing plastic material inside a mold with smooth surfaces. "That design was not getting us the strength we needed," Maffeo said. "By using topography optimization and making slight tweaks to the shape, building panel structures on the outside of the bottle and protruding the bottle outward by a few millimeters, we were able to create a stiffer container. I used OptiStruct for that to show me the locations where these features should be placed for the most strength."Similarly, Maffeo was able to use OptiStruct's topology optimization capabilities to determine how to design some of the internal workings of the container, ensuring that designers were putting material in the proper locations and removing material where it was not needed.

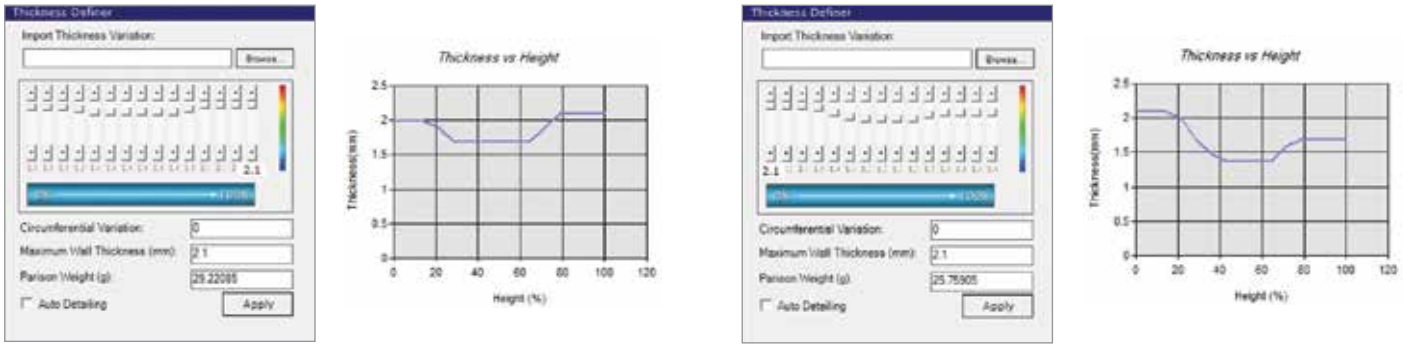
Results: Cost Savings and Shorter Simulation Schedules

"Simulation testing saves a huge amount of money," Maffeo observed, "allowing us to modify designs early on in the process instead of making changes after production tools are created. The accuracy of HyperWorks simulations has been spectacular. We are quite happy with the main types of simulation we do; it has been quite predictive of what we have seen in actual production."

HyperWorks has helped Unilever avoid potential retooling costs and accelerate its design schedule. "I have an allotted amount of time in the development schedule to do simulation work," Maffeo noted.

"When outsourcing the work, that period may have been two months. Now, however, HyperWorks is built into our way of working, allowing us to run the simulations quickly in house; so on major projects, we need to build only two to three weeks into the timeline for simulation."

HyperWorks has become a crucial part of Unilever's packaging design process. "HyperWorks is so integrated into our ways of working that it's hard to picture our process of creating designs without it," Maffeo said. "If we didn't have it, our jobs would be much harder, and there would be a lot more guesswork involved without substance to back it up. HyperWorks is critical—mandatory—in trying to solve so many of the potential issues we analyze."



Process automation tools have been developed to automate many of the simulation steps. The images show thickness definition for the original 22g bottle and the 19g optimized bottle.

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Performance Simulation Technology

HyperWorks is an enterprise simulation solution for rapid design exploration and decision-making. As one of the most comprehensive, open-architecture CAE solutions in the industry, HyperWorks includes best-in-class modeling, analysis, visualization and data management solutions for linear, nonlinear, structural optimization, fluid-structure interaction, and multi-body dynamics applications.

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