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PLM modeling and assembly

Linear Analysis

Robust Design and Optimization

Visualization and Collaboration

Process Automation

Product Development Lifecycle

Project and Data Management



Morphing



Mid-Surface Extraction



Robust Design

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### HyperMesh

#### HyperMorph

A mesh manipulation tool that allows users to quickly parameterize models and stretch finite element meshes.

#### Mid-Surface Extraction

HyperMesh introduces true mid-surface extraction for complex geometries.

### HyperStudy

A parametric study and multi-disciplinary optimization tool for robust design and stochastic studies.

### HyperWorks Process Manager

A programmable work flow manager that intelligently guides users through defined standard work processes.

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# Opportunities in Packaging: & Innovation & Savings

Technology allows companies to efficiently develop cost-effective, high-performance packaging systems.

by Michael Richmond and Brian F. Wagner

What do beer, milk, motor oil and yogurt have in common? Thanks to various consumer packaged goods (CPG) companies, these products offer innovative packaging systems designed with consumers in mind.

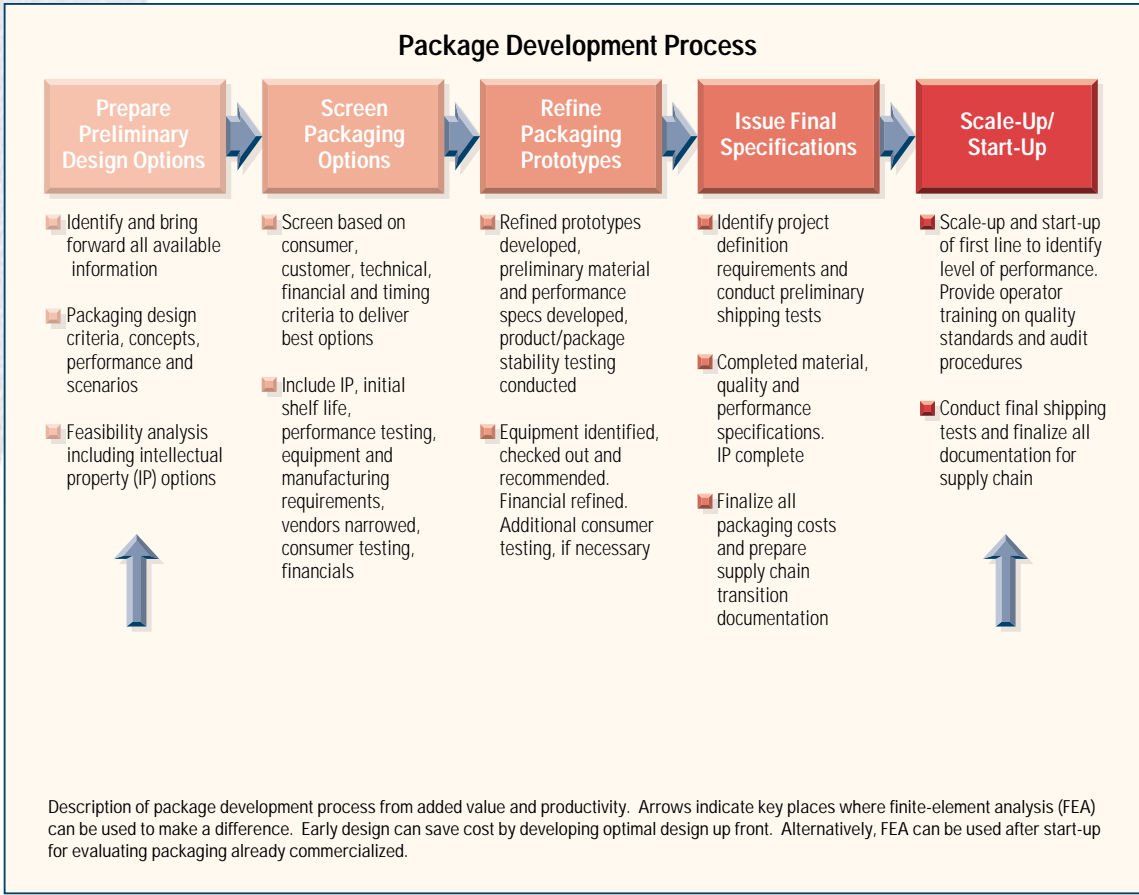
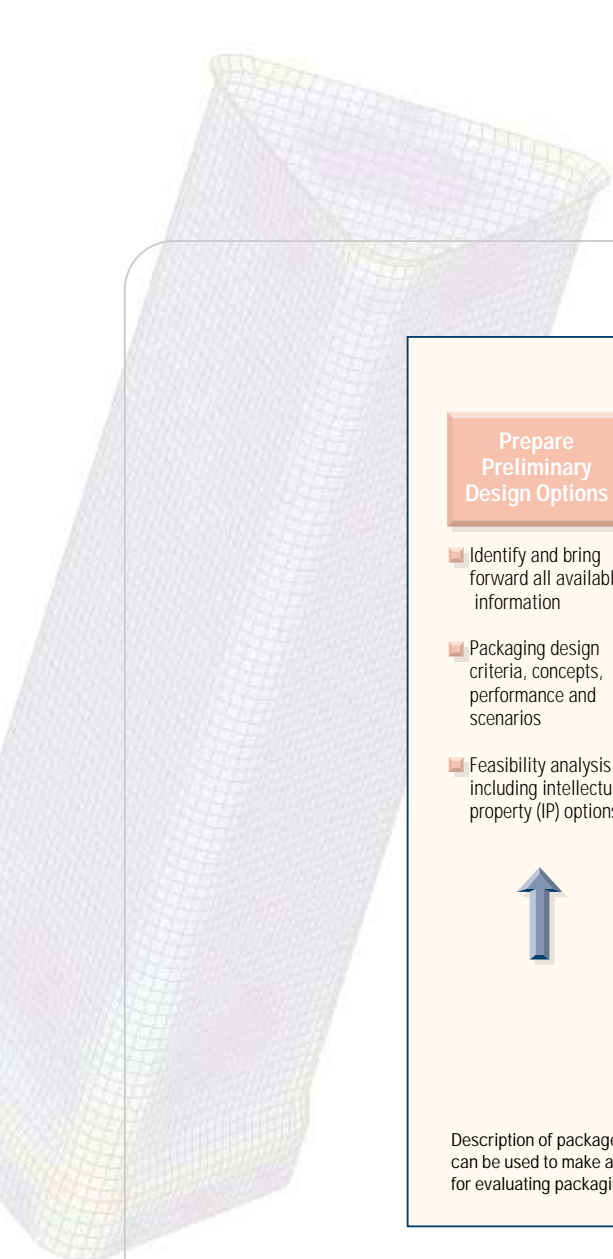
For example, Miller Beer and Deans Milk Chug now come in plastic bottles that are modern, safe and convenient. Motor oils incorporate off-center spouts to reduce product spillage. And yogurt is available in plastic tubes so that you can eat on the go, without utensils.

Because consumers are time-starved, the focus on convenience and performance through packaging is driving new opportunities across packaging categories. In particular, forward-thinking CPG companies are addressing packaging issues up front in their new product development process to achieve better solutions at lower costs.

## More Than Just Product Protection

Today, packaging of products across sectors accounts for a global industry valued at more than \$400 billion dollars, according to reports by Ernst & Young and the World Packaging Organization. Primary packaging sectors include paper, glass, metal and rigid/flexible plastics. Members of the packaging value chain consist of raw material suppliers, converters, CPG companies (such as Clorox, Kraft and Procter & Gamble), retailers and food service.





## A Road Map for the Future of Packaging

Packaging is rising as a crucial management issue. How packaging responds to that changing role is vital to its future. One way to shape your strategic response to the changing scenario is by participating in the proprietary multi-client study, *The Future of Packaging: A Critical Road Map for the Next 10 Years*.

Sponsored by Packaging & Technology Integrated Solutions (PTIS), LLC and Leading Futurists, LLC, the study examines packaging from a business perspective. Participants will meet with peers in the value chain, explore future visions of packaging and receive a road map with insights and recommendations for the future. As a host for the launch, scheduled in late 2003, Altair will share the latest technology trends and the impact that virtual simulation will have on the future of packaging.

*For a description of the program schedule and deliverables, visit [www.altair.com/PTI-Solutions](http://www.altair.com/PTI-Solutions). To register, contact PTIS at 269-375-7031 or Leading Futurists at 202-271-0444.*

These companies serve consumers who shop in a fragmented market. Today, consumer channels include retail grocery stores, super centers, warehouse clubs, drug stores, convenience and gas centers, value stores, home centers, vending outlets, restaurants and the Internet. Twenty-five years ago, grocery stores represented the primary place to shop.

Factors driving consumer purchases range from taste/performance, convenience and nutrition/life quality to variety and value. Fun, time savings, the environment and safety are additional factors consumers consider in product purchases.

Packaging has come a long way since its conception as a discipline at Michigan State University in the early 1950s. At the time, the emphasis on packaging focused on product protection. For decades, it was taught that the sole purpose of packaging was to protect products through distribution into consumers' homes.

In the last 10-15 years, however, the perceptions associated with packaging have changed. In fact,

packaging is now considered the “product delivery system,” and it plays a key role in helping consumers use and interact with products as well as guide their purchases.

### CPG Companies and Packaging

In the general scheme of things, CPG companies develop the consumers’ distribution packaging. Over the past decade, they have sought to improve productivity in their operations and to cut costs in packaging, usually by reducing thickness or light-weighting materials. The majority of the work has been accomplished through trial and error.

The traditional packaging development process has rarely included packaging in the up-front assessment. Instead, marketing typically develops an idea, works with market research and product development to develop the product and then turns its attention towards packaging at the end of the process.

As a result, there is little packaging can do to contribute to top-line growth in this traditional product development process. In fact, packaging may end up negatively impacting bottom-line costs because of the diverse channels through which the new product will be marketed. This model often results in a sub-optimal launch and a very expensive commercialization effort.

Current efforts are more innovative in nature: they are aimed at understanding how packaging can help solve consumer problems and identify new top-line growth ideas. Thus, packaging is an investment for CPG companies rather than an expense.

The optimized package development process includes consideration of packaging issues up front in the development process. A cross-functional team develops the ideas together, defines the leadership, identifies milestones and success factors and recommends consumer work and all channel launches. Additionally, the team manages the project through the commercialization process, providing appropriate metrics and measures to validate success.

### Moving to the Next Level

Too often, CPG companies ignore the natural balance and interplay between innovation, productivity and cutting costs. The result is that they focus solely on innovation and growth, productivity, or on cutting costs.

A better tactic is to follow a balanced approach where there is significant effort towards improving

## The P&G Virtual Packaging System

Procter & Gamble (P&G) is a leader in the consumer products industry, with more than 300 of the world’s most recognized brands. An early technology adopter, it has been applying technology such as finite-element analysis (FEA) to its packaging applications since 1985. Today, business units within P&G are using FEA to solve highly diverse problems ranging from designing bottles and caps to lipstick applicators, mops and more.

P&G analysts typically deal with plastics and paper. Very little work is done with traditional materials, such as steel. The exception is in the design of manufacturing machines.

Recently, P&G, in partnership with Altair Engineering, automated its packaging analysis process. Using commercially available software, a customized interface called the Virtual Packaging System (VPS) was developed to automate the virtual analysis of bottle geometry. The interface guides the analyst through the process while automating the geometry healing, meshing, solution and reporting steps.

Such automation leaves the analyst free to focus on the physical parameters of the design problem rather than the non-value-added steps of setting up analytical solutions. What’s more, the automated solution results in significant productivity gains while improving repeatability and reliability of the analysis.

P&G analysts realized tremendous productivity gains when they used the VPS to design a container for Torengos, a new brand of corn chips the company introduced. The packaging analysis focused on three areas: overall cost feasibility, design for manufacturability and sealing design.

productivity, cost savings and innovation, thus driving top- and bottom-line results. With efforts progressing simultaneously, there is an upside to providing more successful packaging deliverables to the organization year in and year out.

A strong approach to creating a balance among innovation, productivity and cutting costs can be found in applying technology to packaging development. According to Dr. Michael Tanoff of the Department of Mathematics and Computer Science at Kalamazoo College, Kalamazoo, MI, the use of tools such as finite-element analysis (FEA) software allows packaging designers and engineers to efficiently

## Finite-Element Analysis (FEA) Applied to Packaging

- Container performance under mechanical stress—Will a package maintain its integrity when stacked in multiples and during shipping?
- Container performance under thermal fatigue—Will a package maintain its integrity under changing environment conditions? Is a package secure from implosion or explosion? How will new designs in freezing/boiling applications perform?
- Performance of multilayer packaging—The stiffness or flexibility of an innovative multilayer packaging structure is determined not only by the properties of individual layers but also by the arrangement of these layers within the structure. How will such innovative designs perform?
- Structural performance of new materials—Will cost-effective or environmentally friendly packaging materials perform structurally?
- Design of thinner, stronger packages—Will better packaging designs lead to materials cost reduction while maintaining package performance and integrity?
- New packaging shapes for consumer appeal and brand image—Will non-traditional package shapes, developed as part of an integrated packaging solution, perform structurally?

Source: Dr. Michael Tanoff, Dept. of Mathematics and Computer Science, Kalamazoo College, Kalamazoo, MI.

study complex packaging structure and to optimize cost and performance.

Dr. Tanoff identifies several scenarios where it makes sense to use FEA (see *Finite-Element Analysis Applied to Packaging*). For example, packaging designers can evaluate container performance under mechanical stress, thermal fatigue and in multilayer packaging. They can also analyze the structural performance of new materials. In addition, Dr. Tanoff explains that engineers can use this technology to design thinner, stronger packages. What's more, they can introduce innovation into the process by evaluating new packaging shapes for consumer appeal and brand image.

The application of technology to packaging is a new experience for most CPG companies. Yet, it is a

strategic option worth considering. It can save millions of dollars by replacing trial-and-error packaging design with rational math/science-based FEA. The up-front use of FEA can also optimize new product/package design, allowing companies to capitalize on both innovation and cost savings.

For example, using FEA techniques to analytically represent the part and then simulate load and constraint conditions enables designers and engineers to predict the performance of a concept design in advance of any investment in tooling, prototyping or physical test validation.

### Making the Connection

Packaging & Technology Integrated Solutions (PTIS), founded in January 2001, delivers focused strategic and tactical results to CPG companies and others in the value chain. The company has worked for over 50 clients and enjoys an exclusive relationship with Altair Engineering, which provides product design and consulting for virtual packaging testing.

Altair consultants are highly skilled, offer diverse industry experience and can assist companies in any stage of the development process. By leveraging new design technologies such as FEA and development strategies, companies can reduce time to market as well as material and production costs. Just ask Procter & Gamble. Recently, it collaborated with Altair to reduce the time to validate a new package design (see *The P&G Virtual Packaging System*).

With the growth and importance of packaging in many categories and sectors, and with the application of FEA, we will see significant dollar savings delivered through the use of these tools across sectors for years to come. With regard to packaging, the implementation of the technology and the tremendous productivity and innovation opportunities associated with them are in their infancy.

Altair's ability to help clients design more optimal packaging at the onset will reduce development time and provide millions of dollars in on-going savings. With the focus on speed to market, making correct decisions early and providing the best overall value proposition, the application of this simulation software to your packaging needs just makes sense. **C2R**

Michael Richmond and Brian Wagner are co-founders of Packaging & Technology Integrated Solutions, LLC. You can reach them at [www.PTI-Solutions.com](http://www.PTI-Solutions.com).

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