

# When Animation Meets Simulation

Movie-making tools help drive a virtual product evaluation using Abaqus FEA

As film animators know all too well, the human face is one of the most difficult objects to model realistically. A flexible layer of skin covers a complex array of muscles and bones, producing a seemingly endless number of subtle facial expressions.

These subtleties come alive onscreen due to the blending of live action with special effects that is pushing the animation envelope forward: Animators now use computer-based physics in much the same way that design engineers use realistic simulation.

## Modeling Facial Features

Motion capture animation isn't just for making movies. "Representing the positions and movements of the human face is a big challenge in designing some of our products," says Chris Pieper, Associate Research Fellow at Kimberly-Clark Corporation, a leading global health and hygiene company.

Although the company is most known for household brands such as KLEENEX® and HUGGIES®, they also manufacture dust masks, or particle respirators, that are worn by professionals and do-it-yourselfers who are involved in woodworking, machining, and other activities that create by-products that are unhealthy to breathe. The design challenge is to make a mask that's comfortable and at the same time maintains an airtight seal against the changing shape of the face.

For Pieper and his engineering team, the simulation problem was to represent a moving deformable surface—a face—in



Figure 2. Kimberly-Clark Professional Duckbill® dust mask (real and simulated).

contact with a flexible object—a dust mask. "It's crucial that the mask conform to the face," says Pieper. "The contact pressure between the mask and the face is very important to the proper function of the product and the comfort of the user." Pieper, who was familiar with motion-capture methodologies, thought that he could adapt techniques from the entertainment industry to the product development process.

## From Motion Capture to Simulation

Pieper and his group looked to SIMULIA to explore how high-resolution motion-capture data could be used for virtual product design. "Abaqus FEA is well-suited for studying soft,

flexible structures with complex geometry in contact," says Pieper. "The general contact feature makes problem setup easy and solutions stable."

For his analysis, Pieper drew from the computer-generated animation world. He selected Contour™ Reality Capture, a high-fidelity performance capture technology from Mova, LLC. The California-based company recently used its technology to capture the facial movements of actor Edward Norton to animate the face of the green superhero in the 2008 release *The Incredible Hulk*. The Mova system utilizes an array of cameras—much like

