



For immediate release:
August 8, 2014

Contacts: Jennifer Liu
Walt Disney Imagineering
818-544-6130
Jennifer.C.Liu@disney.com

Virginia Perry Smith
Disney Research
818-726-5492
Gini@disneyresearch.com

Disney Research Leads Development of Computational Tool For Designing Inflatable Characters and Structures

Interactive Method Allows Non-experts to Create Intricate Shapes

The air pressure that makes inflatable parade floats, foil balloons and even inflatable buildings easy to deploy and cost effective can be challenging to designers of those same inflatables due to limitations in today's fabrication process, but a new interactive computational tool enables even non-experts to create intricate inflatable structures.

Developed by a team from Disney Research Zurich, ETH Zurich and Columbia University, the method reverse-engineers the physics of inflation as the designer sketches the shape of the structure and the placement of seams. As a result of this process, the system generates patterns for a set of flat panels that, when sealed together and inflated, assumes the desired shape.

The researchers validated their system by designing seven varied shapes, ranging from an elephant to a flower, and fabricating three of them – a teddy bear, a sphere and a fox head – out of PVC plastic sheets. They will present their findings at ACM SIGGRAPH 2014, the International Conference on Computer Graphics and Interactive Techniques in Vancouver, Aug. 10-14.

The system isn't engineered for creating rubber balloons, which stretch when inflated and remains pliant, but for inflatables made from flat panels of materials that don't stretch much but are compliant to bending, such as metallic foil, vinyl or textiles. Designing these structures is a complicated patterning problem, said Melina Skouras, a joint Ph.D. student in computer science at ETH Zurich and Disney Research Zurich. The material must be cut into shapes that, when

- more -

joined together, inflates to the desired shaped.

“This task is extremely challenging since the designer must anticipate, and invert, the effects of pressure on the shape of the structure, while simultaneously taking into account the aesthetics of the seams,” Skouras explained.

To give the designer total control over the final structure, Skouras and her colleagues developed an interactive tool, rather than a totally automated approach. Beginning with the designer’s 3D representation of the desired shape, the system proposes a set of panels to achieve that shape. The designer, meanwhile, can evaluate and move seams as necessary to improve the look or enhance the shape of the structure.

The system also enables the designer to consider internal connections between seams, which make possible more intricate and defined shapes than would be possible with a structure that consists of only a single, enclosed surface.

The researchers developed a fast physics-based model for inflatable membranes that employ tension field theory, which helps to predict the location and direction of wrinkles in the inflated structure.

The system has an intuitive interface that enabled non-expert users to efficiently add, edit and replace seams and explore how these changes affected the final shape. On average, designing a foil balloon took between eight minutes for a simple shapes and less than a half hour for sophisticated models with internal connections. All computations were performed on a standard desktop computer.

In addition to Skouras, the research team included Markus Gross, professor of computer science at ETH Zurich and director of Disney Research Zurich; Bernhard Thomaszewski, Peter Kaufmann and Bernd Bickel, also of Disney Research Zurich; and Eitan Grinspun and Akash Garg of Columbia.

The research was supported, in part, by the Swiss National Science Foundation.

More information, including a video, is available on the project web site

<http://www.disneyresearch.com/project/designing-inflatable-structures>.

###

- more -

About Disney Research

Disney Research (www.disneyresearch.com) is a network of research laboratories supporting The Walt Disney Company. Its purpose is to pursue scientific and technological innovation to advance the company's broad media and entertainment efforts. Vice Presidents Jessica Hodgins and Markus Gross manage Disney Research facilities in Los Angeles, Pittsburgh, Zürich, and Boston and work closely with the Pixar and ILM research groups in the San Francisco Bay Area. Research topics include computer graphics, animation, video processing, computer vision, robotics, wireless & mobile computing, human-computer interaction, displays, behavioral economics, and machine learning.