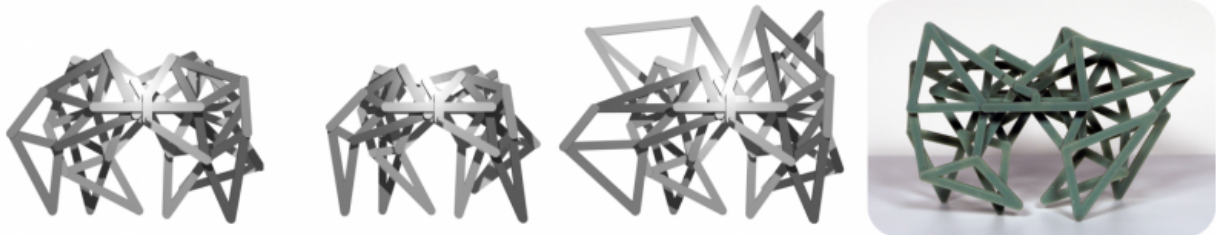


# Interactive editing tool enables personalization of planar linkages

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Disney Research has created LinkEdit, interactive software for predictably changing the shape or motion of planar linkages used in such objects as kinetic sculptures, folding furniture and mechanical toys.

The LinkEdit software enables users to make desired changes in a linkage, such as altering its size or shape, while preserving other features, such as the walking gait of a linkage for a mechanical leg. The researchers demonstrated this capability by making alterations to the Jansen linkage, the building block to the famous walking sculptures created by artist Theo Jansen known as Strandbeests.

Planar linkages are combinations of links and joints that can exert force or create a desired motion. They are found in a wide variety of common devices, including locking pliers, windshield wipers and scissor lifts.

Linkages can be difficult to design, but a wide variety of linkage designs is available online and can be readily made using 3D printers.

"Conceiving a complex linkage is beyond the capability of average users," said Bernhard Thomaszewski, a research scientist at Disney Research. "But existing designs often inspire new interpretations or reuse in a different context. Without a tool such as LinkEdit, however, attempts at changing the shape or motion of a linkage can have unexpected results."

Thomaszewski and his colleagues, Moritz Bächer and Stelian Coros, will present LinkEdit at ACM SIGGRAPH 2015, the International Conference on Computer Graphics and Interactive Techniques, in Los Angeles Aug. 9-13.

To make LinkEdit as interactive and robust as possible, Bächer said the team used an approach called "symbolic kinematics" that is computationally efficient. In contrast to standard approaches that require solving nonlinear systems of equations to simulate all of the joint interactions at once, symbolic kinematics makes it possible to decompose the mechanism into independent parts that can be processed in isolation and in order.

LinkEdit provides a variety of tools that allow the user to change the position of joints within a linkage, alter the motion of the linkage at selected points or limit the overall size of the linkage. The method is suitable for a large set of well-known and widely used mechanisms, said Coros, who now is an assistant professor in Carnegie Mellon University's Robotics Institute.

In the case of the Jansen linkage, for instance, the researchers were able to make substantial changes in the shape of the linkage while maintaining its distinctive gait. They also demonstrated that they could

use a motion envelope tool to rescale the Jansen linkage to fit in a narrower housing while again keeping the characteristic [motion](#) of the feet intact.

**More information:** [www.disneyresearch.com/publication/linkedit/](http://www.disneyresearch.com/publication/linkedit/)

Provided by Disney Research

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