Twists through Space

Interactive software helps sculptors visualize and refine their creations

By IVARS PETERSON

Brent Collins has spent more than a decade carving gracefully curved sculptures out of wood. Born from his imagination, rendered in wire and wax, then painstakingly realized in wood in his Gower, Mo., workshop, each creation demands many weeks of labor.

Now, Collins has a high-tech collaborator. Intrigued by Collins' artwork, computer scientist Carlo H. Séquin of the University of California, Berkeley has developed an innovative computer program for creating sculptors' models. "It allows you to try out new designs without having to spend weeks making physical prototypes," Séquin says.

Séquin and Collins described their joint work at the Art and Mathematics Conference this month in Berkeley, Calif.

Collins is not a mathematician, yet his intuition and aesthetic sense have led him to explore patterns and shapes that have an underlying mathematical logic. Many of his sculptures display the characteristic curves of minimal surfaces, which fill in a boundary with the smallest possible area. In three dimensions, these surfaces have a saddle shape, as seen in soap films spanning wire frameworks

(SN: 2/17/96, p. 110).

Collins has recently created a family of sculptures in which each piece consists of a punctured ring of intertwined saddle surfaces. These sculptures can be described as different ways of warping pieces of an infinite mathematical shape called Scherk's second minimal surface.

Although a computer scientist by trade, Séquin creates three-dimensional art as his hobby. His professional specialty is the computer-assisted design of objects, such as complicated machine parts, and the production of plastic or ceramic prototypes using stereolithography (SN: 8/3/91, p. 72) and other fabrication techniques. His test pieces are often small sculptures.

Using Séquin's sculpture generator, Collins specifies a unit, based on a piece of a Scherk surface, having a specific number of holes and saddles. That unit can then be stretched, twisted, bent into an arc, or joined end-to-end in a ring. The artist can also adjust color, surface texture, and edge thickness and even add a background scene to see how the final sculpture would look in a particular setting.

The original version of Séquin's software only worked on a Scherk surface. In later editions, Collins could play with other curves and shapes.

"The sculpture generator is wonderful," says mathematician and sculptor Nat Friedman of the State University of New York at Albany, who recently used the software to create a structure of his own. "The fact that one can design a really interesting form and then have an actual three-dimensional model made of it is what I would call sculpture heaven."

Séquin's sculpture generator is not avail-

Pax Mundi. *This recent bronze sculpture by Collins consists of a concave ribbon winding through space. Séquin is enhancing his computer program to assist the fabrication of such designs.*

able as a commercial product. "It's a research tool," Séquin says. "Students who work on it learn many techniques applicable to other [design] software. They learn a lot about how these programs have to be structured to make them fast, interactive, and easy and enjoyable for people to use."

Séquin and his students continue to improve the sculpture generator. The latest version allows a designer to experiment with a greater variety of transfor-

Heptoroid. *The computer not only depicted the prototype of this intricate sculpture but also created templates of cross sections. Collins used those templates to carve the 33-inch-high sculpture from laminated mahogany.*

mations. It can also deliver blueprints—depicting slices through a sculpture—that an artist can use to fashion a full-scale model.

"This is a thrill for me," Collins declares. "The collaboration has enriched my imagination with new possibilities." He envisions designing large sculptures, made from metals, that would bring his distinctive, flowing style to public spaces. □
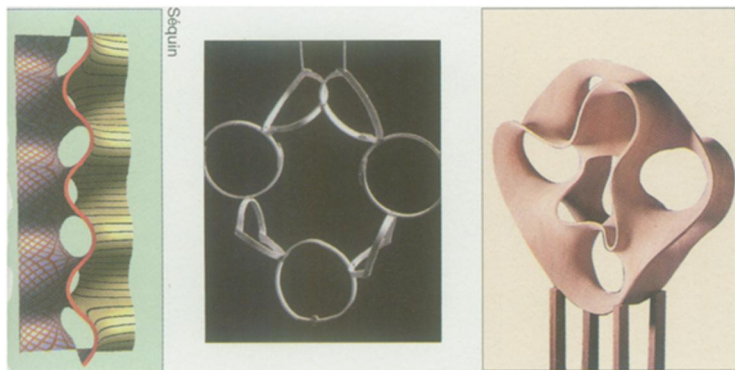
Hyperbolic Heptagon. *Starting with a seven-hole Scherk tower (left), computer scientist Carlo H. Séquin used his sculpture generator software to stretch, twist, and bend that structure into a ring of saddle surfaces. Beginning with the same idea, sculptor Brent Collins first fashioned a wax prototype incorporating an armature of seven linked loops to represent the underlying saddle geometry (middle). Carved from wood, the result is a sculpture about 21 inches tall (right).*