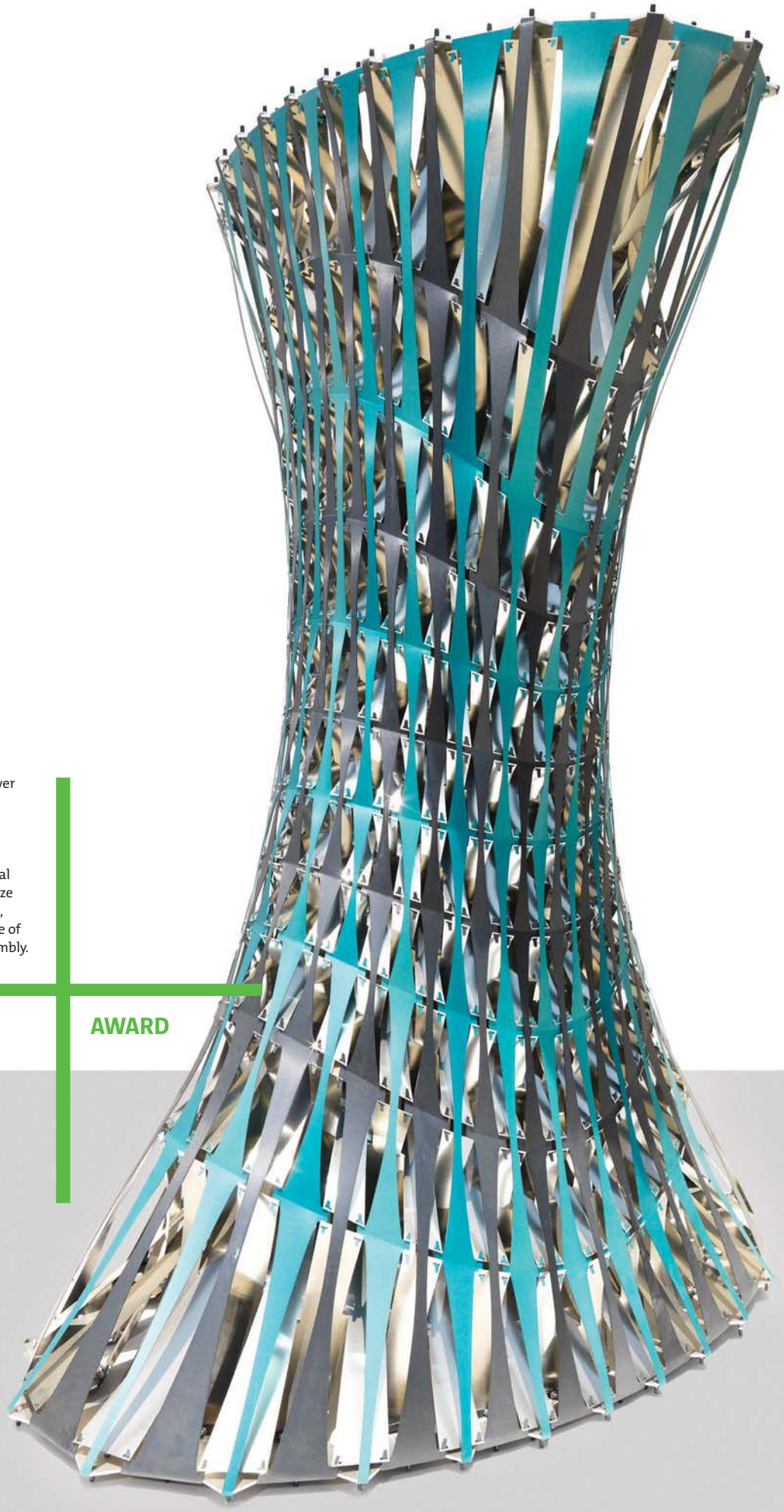

The Exo Structural Tower was built based on intuition and physical mock-ups, but Do|Su Studio Architecture hopes to develop digital data models to optimize the material thickness, dimensions, and shape of each piece in the assembly.

**AWARD**

JUSTIN FANTL

# Exo Structural Tower

## DO|SU STUDIO ARCHITECTURE FOUNDER DORIS SUNG AIMS TO CREATE SMART ARCHITECTURE THAT CAN SELF-ASSEMBLE.

Doris Sung, Assoc. AIA, envisions a future in which architecture is more than just smart—it also responds intelligently to its environment. A smart building "is not just about having a Nest-type thermostat," she says. "That's a smart gadget, not smart architecture."

Over the past seven years, the founder of Do|Su Studio Architecture and assistant professor at the University of Southern California has explored the smart potential of thermobimetals: laminated sheets of two metals with different coefficients of thermal expansion. When heated, one side expands faster than the other, causing the material to curl, a property long exploited by thermostats as well as Sung's Bloom installation—a 2012 ARCHITECT R+D Honorable Mention recipient—in Los Angeles.

Sung's latest prototype, Exo Structural Tower, harnesses this curling behavior to achieve fastener-free construction of a lightweight structural shell, or exoskeleton, that essentially self-assembles. Just one or two people equipped with an oven, a pair of welder's gloves, and a ladder can build the 8-foot-tall Exo tower, Sung says. First, the thermobimetal strips, which are laser-cut with notched ends, are heated to 350 F. At this temperature, the two laminated alloys of nickel, iron, and manganese curl into a C-shape. Meanwhile, 100-inch-long strips of anodized aluminum are hung from a 6-foot-by-4-foot elliptical ring, forming a vertical tube.

Each of the 336 curled thermobimetal strips are then inserted, via their end tabs, into a predetermined slot in the aluminum strips, following a numeric system printed on each component. Within 30 seconds, the strips cool and straighten out, locking into place and forming a pre-tensioned beam, like an archer's bow. The tower, which Sung estimates can bear a load of 1 ton, can only be taken apart when reheated to a high temperature.

"The structure is doing its work in the most efficient place—the outer shell," said juror Bill Kreysler. He was also impressed that the structural components could be assembled with "no welders, no saws, and virtually no energy." Juror Gerardo Salinas said, "I like that it can be on a building scale, or on an object scale. I wonder if this could turn into a real skyscraper." Indeed, Do|Su envisions Exo as just one tier of a multi-tiered tower.

### Construction Sequence