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Enveloping Buildings in Textiles

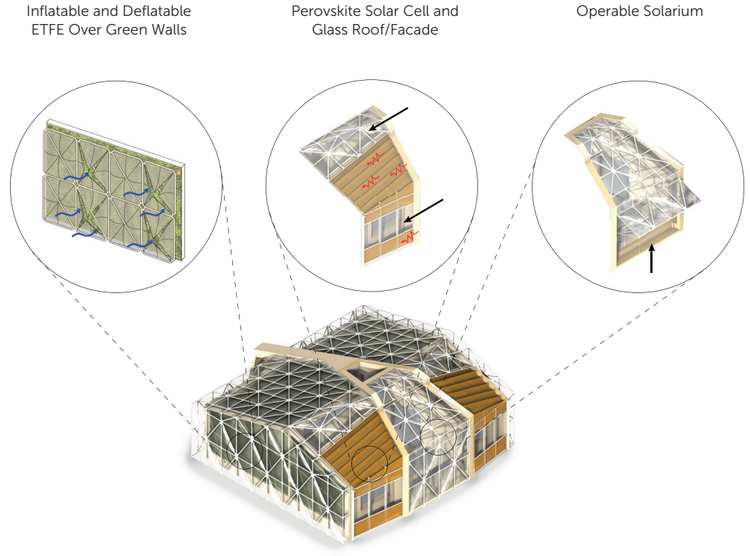
A student team guided by Dr. Ku designed a building envelope, in collaboration with academic partners in China for the Solar Decathlon 2021 Design Challenge. Details of the adaptive structure are shown below.

Enveloping Buildings in Textiles

There are myriad elements that determine how well a building functions. One of the most important and complex is the design and composition of its envelope. Similar to the human skin, the building envelope is the boundary between interior and exterior, and it has multiple functions: protecting the indoor environment, facilitating climate control and reducing the building's energy consumption.

Kihong Ku, DDES, associate professor of Architecture, broadly focuses on how technology empowers designers to enhance design capabilities. Currently, he's working to improve building envelopes through innovative application of textile materials, using advanced computational design and fabrication technologies.

"Building envelopes have come a long way from when stone and brick were used for both a building's structure and its skin," Dr. Ku explains. "Today, we are developing envelopes made of textiles—such as fiber-reinforced composites and fabric- or foil-membranes—that enable the expression of lightness and controlled transparency and that meet growing requirements for 'intelligence' and sustainability."



Dr. Ku is investigating how to take full advantage of emerging innovations in textiles and fibers. For example, he is developing reconfigurable mold systems that enable cost-effective production of complex-shaped fiber-reinforced composite panels for building envelopes. He is also working on adaptive building envelope systems that use embedded sensors and actuators to adjust shading and ventilation mechanisms in response to changing temperature, sunlight and weather conditions.

"My projects take advantage of cutting-edge computational design and fabrication technologies," Dr. Ku says, "but, frequently, they also depend on interdisciplinary collaborations with colleagues and students in textile design and textile engineering. These partnerships have been very fruitful: We have developed new forms or techniques for making things; but more than that, we have learned to bridge our disciplines' fundamental thought processes, creating new approaches that integrate those distinct ways of thinking." ■ KM, MM