

Paper Folding to Foldable Composites

Joseph Choma

keywords: design, folding, composites

Abstract

This research has developed a process that allows fiberglass to fold like paper. By selectively coating resin on fiberglass cloth, parts can fold along the fabric hinges. The innovative technique eliminates the need for any molds or fasteners, while allowing for infinite variations and flat-packing capabilities. After numerous small scale studies, the work has quickly transitioned into a larger inhabitable proof-of-concept built artifact. The first of these artifacts is called: Chakrasana —an accordion arch based on a variation of a folded plate structure. The lightweight, 400 pound, pop-up pavilion was designed, fabricated by hand and installed by five people within 30 days.

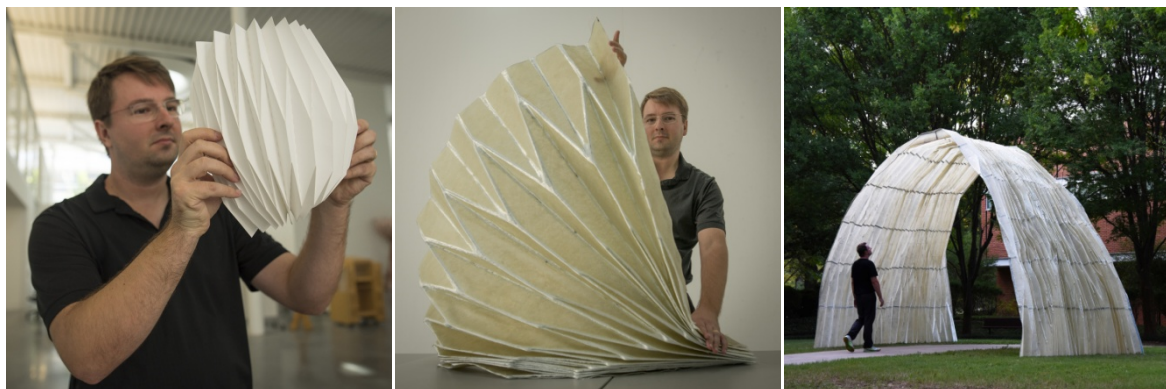


Figure 1: From paper folding to foldable composites to folded plate structures.

Similar to paper folding, the process begins with a crease pattern composed of mountain and valley folds. Two 54 yard long rolls of 33.3" fiberglass cloth were stitched together using a full flat felled seam to create one continuous 32' 10" x 21' 9" sheet, with zero material waste. All the edges were precisely sewn to prevent sharp, rough or frayed edges. Using a painter's masking tape, a crease pattern was drawn on the fabric surface. The intricate pattern was composed of a total of 875 folds, where each accordion fold had a depth of 5". All the planar portions of the structure were then painted with resin. After the resin cured, the tape was removed and the structure was folded and compressed into less than a 12" width. The flat-packed structure was then easily carried by four individuals and transported to the site. A light scaffolding was constructed on the site in one day. Then, the folded fiberglass was placed above the scaffolding with a team of five. After another day of applying resin to each of the creases, the scaffolding was removed, resulting in an extremely thin, lightweight

structure, spanning 16'. This research suggests a means for fiberglass to transition from being a secondary component to a primary building material.



Figure 2: The fabrication process allows the structure to flat-pack to less than a 12" width.



Figure 3: The lightweight folded plate structure spanned 16'.