





Metal Euplectella Folie

Scope : CIFRE PhD Thesis - Nicolas LEDUC, in collaboration with the Laboratoire Navier and VIRY

Date : 2017

"Metal Euplectella Folie" is a prototype that explores an innovative method of design and fabrication for bespoke architecture. By stitching together four 40-meter-long steel strips, each cut according to a unique pattern and then spirally wound, it allows for the creation of a complex form without adjustments, assembly plans, or templates.

This experimental construction results from the intersection of two vastly different inspirations. Its organic morphology and structural shell behavior are derived from Euplectella Aspergillum, a deep-sea sponge found in the western Pacific. Its fabrication method, on the other hand, originates from the industrial process of manufacturing helical tubes. These tubes, typically of large cross-section and thin walls, are formed by continuously winding a straight, constant-width strip into a helical cylinder. By allowing the strip to take on any shape and variable width, this approach unlocks new formal possibilities.

In the design of this prototype, not one but four developable strips, each approximately 40 meters long, were modeled in three dimensions and then subdivided into 72 galvanized steel panels, each 1.5 millimeters thick. The flattened forms of these panels serve as cutting templates, encoding all geometric and assembly process information through their unique edge shapes, perforation locations, and engraved reference marks. As a result, assembly was completed in just four days by two people in the company's workshop—without the need for plans or templates.

This first prototype hints at potential applications for creating fluid, continuous, and structurally efficient spaces made possible by this innovative construction method. Future developments could include more daring geometries—currently limited by transportation constraints—or more complex topologies, such as multi-branching tubes, while maintaining the construction benefits demonstrated here.

This construction was developed by Nicolas Leduc as part of an ongoing CIFRE thesis titled "Building with Developable Surfaces." It is the result of close collaboration between the Navier Laboratory (www.thinkshell.fr/fr), the company VIRY (www.viry.fayat.com), and T/E/S/S.

After being showcased at the École Nationale Supérieure d'Architecture de Versailles, the prototype has been on display since October 17, 2017, at École des Ponts ParisTech in Marne-la-Vallée.