

Switchable ETFE cushion: designing and building a model for experimental testing

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Abstract

Adaptive façade systems have the potential for saving energy and enhancing comfort conditions in buildings. Creating working models with materials, components and functions which embody the design idea of a responsive building envelope is an important part of the design process of these systems, because it allows the performance to be demonstrated and tested under realistic conditions and for difficulties to be detected in advance. This paper reports on the process of building and programming a functional model of a switchable ETFE cushion for preliminary performance tests. Different techniques of reverse engineering and prototyping were explored on a range of scales to build the membrane structure and its pneumatic control system. The study showcases the inter-link of advanced manufacturing techniques and parametric design software, the application of microcontrollers, actuators and sensors in combination with the building envelope. The paper further documents and theorizes the process from design to making and testing, outlining a practical workflow for the development and prototyping of adaptive building envelopes for energy efficient buildings.

Keywords: ETFE, Adaptive Building Envelope, Prototyping, Testing