

ARCH 5116, ARCH 8913 & ARCH 4101/4102, 5101: Option Studio
Cornell University, AAP Department of Architecture / Spring 2019; 6 Credits

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Robot: SULLA; ABB IRB 4600; payload capacity = 45kg; 2.05m reach and 6 axis rotation

Matter Design Computation: *Human-centered Adaptive Architecture in the UAE*

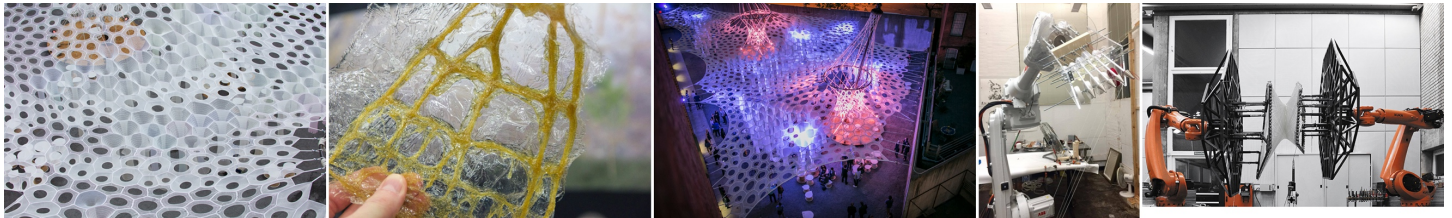


Figure 1 – Left to right: Lumen detail by Jenny Sabin Studio; 3D printed chitosan, 2016 Option Studio + Sabin Design Lab; Lumen by Jenny Sabin Studio; Fiber-winding end effector, 2016 Option Studio + Sabin Design Lab; A robotic fabrication process involving two interacting 6-axis robots to produce doubly curved glass and carbon fiber reinforced polymers through a winding process, Copyright: © ICD/ITKE University of Stuttgart

Frei Otto also took up the notion of self-generation and the analogy between biology and building, but eschewed the imitation of nature in favor of working directly in materials to produce models that were at once natural and artificial. At the same time, he also eschewed their translation into a universalizing mathesis. Rather than focusing on form or formula, he took the idea of analogy in an entirely different direction, preferring to stage experiments in which materials find their own form. – Detlef Mertins

RATIONALE

How might buildings behave more like organisms responding to and adapting to their built environments?

In the not so distant future, materials will not just be elements and things in buildings, they will generate immersive spaces, acting upon and responding to affordances in our built environments. Like the cells in our bodies, sensors and imagers will learn and adapt, making materials not only smart, but also aware, sensate and beautiful. We will be able to tune our spaces, to personalize architecture.

This studio will explore current and future applications of human-centered adaptive architecture in extreme climates for outdoor public programming, including parks, beach activation, recreation, and play. To do this, we will incorporate digital and robotic fabrication with an emphasis upon user feedback through handcraft and external bioinspired datasets and models. We will focus upon materially-directed generative fabrication inspired by natural systems, specifically natural fiber and textile composite structures (i.e. bone, sea sponges, plant fibers, cellular systems). The studio aims to advance materials research and robotic digital fabrication through questions that probe the economical, ecological and cultural production of complex built form in extreme climate conditions. While nonlinear concepts are widely applied in analysis and generative design in architecture, they have not yet convincingly translated into the material realm of fabrication and construction. How have these advancements impacted material practice in architecture, engineering and construction at economic, technological and cultural levels? How might we address these issues during the design process? The main thrust of this studio concerns the evolution of material and digital complexity through radical experimentation in robotic fabrication and digital handcraft with the following themes: Static and interactive robotic drawing; Materials research; Natural fiber-based systems and composite structures; Additive manufacturing and custom end effectors and sensors; Component and part fabrication; 1:1 scale prototypes and structural elements.

The expected outcome for the studio is for students to develop an integrated architectural proposal and program for the Makers District beach activation project (see site info. below) through materially-directed generative fabrication and the production of 1:1 scale prototypes and structural elements (canopy, column, tower, etc.). The final project must represent a thorough design idea documented by material investigations, models, prototypes, drawings, tectonic strategy and sections, overall and partial views and diagrams illustrating the concept and its development into a coherent architectural proposal.

SITE + TRAVEL

This studio anticipates a \pm weeklong field trip February 16 to 22 to visit sites in Abu Dhabi and perhaps, Dubai. We will work with local developers and architects, including **IMKAN/Soulful Places. Enriched Lives**. Our site is a beach area within the Makers District, a mixed-use development strategically located in Reem Island in Abu Dhabi, across from the cultural hub of Saadiyat Island, home to the Zayed National Museum, Louvre Abu Dhabi and Guggenheim Abu Dhabi. We will focus on the waterfront activation development.

*500 field trip contribution per student is required.