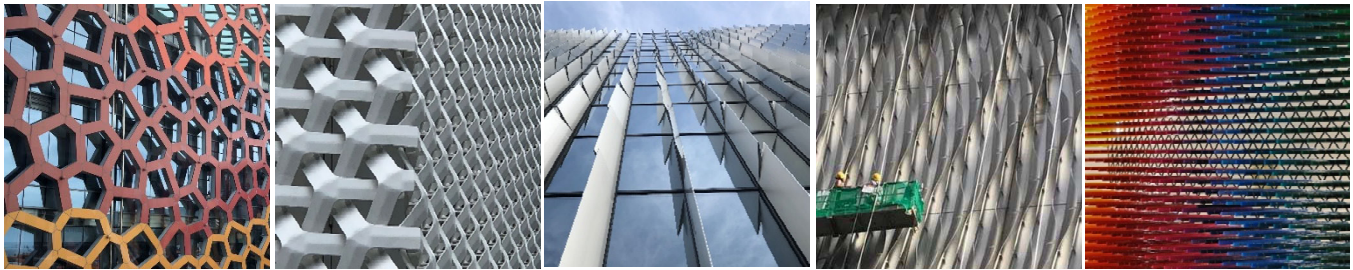


Net Zero Energy Retrofitting: Adaptable Kinetic Facades

ARCH 7104 Diploma Studio Spring 2021 Prof. Kyoung Hee Kim, PhD AIA NCARB [kkim33@uncc.edu, Rm 227]



[Promise] We live in an era that faces global challenges of climate changes and resource depletion. With the rapid urbanization and growing energy consumption, building facades become ever more important in architectural practice and environmental stewardship. As existing buildings are responsible for more than half of the total energy consumption and CO₂ emission, energy efficient retrofitting promises a significant opportunity for energy and saving and emission reduction. There has been an increase in the integration of kinetic facades in contemporary buildings due to its environmental potentials and aesthetic construction. The kinetic façade can be one of sustainable solutions for net zero energy retrofitting.

[Problem] Building envelopes in contemporary buildings play an important role as a micro-climate controller and an aesthetic performer. One of primary problems of contemporary building enclosures is its “static” nature in relation to its “dynamic” environment. The studio focuses on kinetic building enclosures that correspond to dynamic environments in space, program, time, and occupants to balance multi-faceted design requirements as a mediator between indoor and outdoor.

[Objectives] This Diploma studio focuses on the design of a multimodal kinetic façade system. The studio activities consist of desk survey, parametric modeling, performativity measurements, prototyping, discussions, lectures, pin-ups, and reviews to maximize two primary learning objectives:

- The studio serves as a summative experience for the professional MArch degree.
- Design a project that exhibits conceptual, formal, aesthetic, technological and experiential clarity, criticality and sophistication, as it pertains to varying instructor-led themes.

[Project] The project is a *net zero energy refitting with kinetic facades* that contributes to innovations and vibrancy of the city of Charlotte. Kinetic façade system(s) should enhance microclimates of the built environment, economy, energy production, CO₂ reduction, and/or user wellbeing, focusing on one of the followings. Kinetic façades consider six degrees of freedom and address design goals of thermal, illuminous, air-flow, and user responses as well as aesthetic quality. The project should create a compelling narrative for promoting the triple bottom line of sustainability for the city.

- **Active kinetic façades:** active systems deploying to predictive measures and/or real-time measures
- **Passive kinetic façades:** material systems passively responding to heat, air, and moisture (HAM).
- **Bio kinetic façades:** biomimetic responsive systems following functional strategies found in nature.

[Evaluation] This project is evaluated on architectural design quality, relevancy, and caliber of execution. The distribution of cumulative course assignments are as follows:

Assignment Description	Weight for Course (%)
Design project activities (total)	85%
Formal project presentations and documentation	<u>15%</u>
	100%

[Bibliography]

- Juaristi, M., Gómez-Acebo, T. and Monge-Barrio, A. “Qualitative Analysis of Promising Materials and Technologies for the Design and Evaluation of Climate Adaptive Opaque Façades.” *Building and Environment* 144 (2018): 482–501
- Kolarevic, B., Parlac, V. *Building Dynamics: Exploring Architecture of Change*. New York: Routledge, 2015
- Moloney, J. *Designing Kinetics for Architectural Façades*. New York: Routledge, 2011