Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

/ ITA
Institute of Technology in Architecture
Faculty of Architecture / ETH Zurich

DESIGN OPTIMISATION OF SOFT ROBOTIC ACTUATOR FOR ADAPTIVE SOLAR FACADE

Master Thesis / Semester Project

Soft robotics has gained a lot of attention in recent years, by offering solutions to problems where classical robotics failed to succeed. One example is the soft-robotic driven modular solar façade, currently being developed at our chair (http://www.systems.arch.ethz.ch/research/asf-adaptive-solar-facade.html). The façade allows for fine control of solar heat gains as well as optimal energy harvesting through solar tracking, thus carrying a great potential for improving building energy performance and occupant comfort.

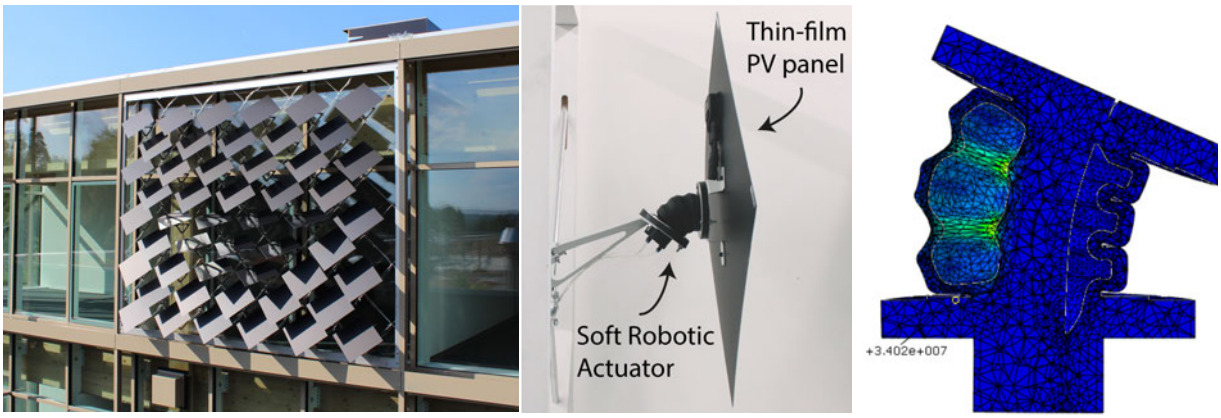

Figure 1. *Left:* Adaptive Solar Façade at ETH Hoenggerberg Campus. *Middle*: Single façade module. *Right*: FEM simulation of soft actuator

Several actuator prototypes have been already designed, fabricated, and implemented on building-scale facades. We are currently working on optimising the design of the soft actuator in order to improve its durability in terms of number of cycles, and its controllability in wind. The goal of this thesis is to analyse kinematics and stress-strain behaviour of the bellow-like pneumatic actuator and propose an optimal design that reduces the stress in the material during inflation and provides necessary forces to counteract certain wind disturbances.

We are looking for motivated students with background in robotics to support our research. Previous experience with finite element method (FEM) software (e.g. ABAQUS) and/or knowledge of mathematical optimisation is beneficial, but not necessary. Please send a summary of previous experience (e.g. BSc thesis, etc.) with your application.

Contact: Bratislav Svetozarevic
svetozarevic@arch.ethz.ch

Architecture & Building Systems
Prof. Dr. Arno Schlüter
ETH Zurich / Building HPZ / Floor G
John-Von-Neumann Weg 9 / CH-8093 Zurich
http://systems.arch.ethz.ch