



MECHANICAL ENGINEERING PhD SEMINAR

Monday, July 27, 2026, at 14:30, Lady Davis Building, Auditorium 250

Leveraging Flow and Multi-stability in Metafluids and Soft Robotics

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Multistable structures provide a powerful route for achieving programmable shape morphing, controlled deployment, energy storage, and adaptive mechanical behavior without continuous actuation. My doctoral research focused on developing instability-based fabrication strategies that harness directed mechanical instabilities as a design tool for creating multistable structures across multiple length scales.

Instead of treating buckling and nonlinear deformations as failure mechanisms, this work uses them as a tool for programming multistable structures and reconfigurable geometries. By combining geometry and controlled mechanical instabilities, these approaches enable rapid and scalable fabrication of structures capable of twisting, bending, and extending. This framework provides a simple and versatile route for designing multistable structures beyond the limitations of conventional fabrication methods such as casting and additive manufacturing.

In this seminar, I will present the underlying fabrication principles and demonstrate how instability driven architectures can be integrated into functional systems for soft robotics, adaptive materials, and deployable structures. Applications include growing soft robots capable of maneuvering confined environments, multistable metafluids for energy harvesting and thermal management, reprogrammable metamaterials with tunable three-dimensional shapes, and rapidly deployable reinforced concrete structures.

The seminar will highlight how controlled instabilities can serve not only as a mechanical phenomenon, but as a unified design framework for creating scalable and reconfigurable systems with programmable functionality. The presented work is based on studies published in *Advanced Materials*, *Nature Communications*, *Materials Today Physics*, *Advanced Materials Technologies*, *Advanced Engineering Materials*, and *Physical Review Applied*, including collaborations with Columbia University, University of Michigan, Westlake University, and the University of Ljubljana.

Note: the seminar will be given in English