# MECHANICAL ENGINEERING STUDENT SEMINAR

**Thursday, February 20, 2025, at 13:30**, D. Dan and Betty Kahn Building, Room 217.
**Online:** https://technion.zoom.us/j/98000328409

## Organization of bistable materials under periodic drive

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Disordered materials subject to periodic drive often trigger microscopic structural rearrangements that iteratively alter the material's properties. This process gives rise to nontrivial phenomena such as, memories, yielding and emergent limit cycles, where the microscopic states are sequentially revisited. The goal of the research is to gain insight into these phenomena from the perspective of the structural organization that stems from the periodic driving.

We conduct computer simulations of a two-dimensional disordered network of bistable springs, recently proposed as a model for crumpled thin sheets. The model is comparatively simpler than glasses, yet retains the complex energy landscape of glasses. We shear the network repeatedly at various strain amplitudes using an athermal quasi-static protocol. At small amplitude the system settles into limit cycles, while at large amplitude the evolution is erratic and non-repetitive. A sharp continuous-like transition separates the two phases, accompanied by diverging time scales. The large amplitude phase is characterized by large stress drops that scale inversely with the system's length.

We explore the structural organization of the rearrangements. For the large part the rearrangements are polarized along the shear direction. Below this threshold, local instabilities remain confined and exhibit only short-range correlations. Above it, diagonal bands of instabilities emerge, marking a cooperative deformation pattern spanning the network. The distance between bands grows near the transition and appears to diverge, consistent with critical phenomena. We propose a simple variational argument that explains the transition.

Note: the seminar will be given in English