MECHANICAL ENGINEERING STUDENT SEMINAR

Thursday, June 2 2022 at 13:30, Betty and Dan Khan Building, Auditorium 1.
Online: https://technion.zoom.us/j/7792211031

Dynamics and minimalistic control of a flexible structure containing bi-stable elements

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This study aims to design and analyze a system of mechanically-coupled bistable elements such that transitions between states (different equilibrium branches) take place in a desirable order by controlling a single degree of freedom. Such systems may be useful in a range of applications, e.g. soft robots or foldable structures, where a complex sequence of movements or configurations needs be achieved by minimal control. The theoretical part involves analytical and numerical investigation of the non-linear dynamic response of an array of bistable elements connected in series. The model accounts for the non-linear behavior of the bistable elements assuming linear damping and negligible inertia where the only control input is the displacement at the end of the chain (u_0). The quasi-static and dynamic response of a chain of two elements is studied. Focus is put on the multiplicity of equilibrium states, stability, and conditions for transition between stable states. Special attention is given to identifying critical rates that separate between different transition sequences, and how they are influenced by the properties of the bistable elements and the variability between them. We show, and demonstrate experimentally, that by clever design of the bistable elements, one can robustly control the order of transitions between states by merely varying the rate (speed) of the applied overall extension.

Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Sefi Givli.