Technion-Israel Institute of Technology
Faculty of Mechanical Engineering

הטכניון-מכון טכנולוגי לישראל
הפקולטה להנדסת מכונות

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות שתתקיים ביום ה' 28.03.2019 (כ"א באדר ב', תשע"ט), בניין דן קאהן, אודיטוריום 1, 13:45.

מרצה: יואב מתיא

מנחה: פרופ"מ אמיר גת

על הנושא:

Creating Complex Deformation Patterns and Increasing Effective Rigidity of Elastic Plates and Beams via Viscous Flows in Complex Internal Channel Networks

The seminar will be given in English

תקציר ההרצאה :

In this work we analyze the transient dynamics of solid-fluid composite structures. This is an interdisciplinary research subject, which lies on the border between theoretical fluid mechanics, soft-robotics and composite-structures. We focus on an elastic beam embedded with fluid-filled cavities as a representing common configurations. Beam deformation both creates, and is induced by internal viscous flow, where changes to cavities' volume are balanced by a change in axial flux. As a result, pressure gradients develop in the fluid in order to conserve mass, and stresses are induced at the solid-fluid interface; these in turn, create local moments and normal forces, deforming the surrounding solid and vice versa.

We study three different physical regimes. First we focus on a model of an elastic beam embedded with a slender fluid-filled serpentine channel. We examine the dynamic regime where the fluidic viscous-elastic time scale is significantly shorter than the solid-inertial response; rendering viscosity effects negligible. Second, we expand on the previous configuration, and focus on the introduction of viscous flow; extending the range of actuation modes enabled via viscosity. Last, we generalize the configuration to an elastic beam embedded with a set of fluid-filled cavities, similar to a honeycomb structure, and interconnected by an array of slender tubes. We examine the dynamic regime where both viscous-elastic and inertial-elastic time scales are dominant, and expand the model to include large deformations, as well as a two-way coupled fluid structure interaction.

The results of the presented research can be applied to define the required geometric and physical properties of solid-fluid structures in order to achieve specific responses to external excitations, thus allowing to leverage viscous-elastic dynamics to create novel soft-actuators and solid-fluid composite materials with unconventional mechanical properties.

בברכה,

פרופ"א מתי סאס
מרכז הסמינרים