MECHANICAL ENGINEERING STUDENT SEMINAR

Wednesday, November 16, 2022, at 13:00,
Online: https://technion.zoom.us/my/alanmuhafra

Electromomentum coupling in
piezoelectric metamaterials

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Homogenization theories provide models that simplify the constitutive description of heterogeneous media while retaining their macroscopic features. These theories have shown how the governing fields can be macroscopically coupled, even if they are microscopically independent.

A prominent example is the Willis theory which predicted the strain–momentum coupling in elastodynamic metamaterials. Recently, a theory that is based on the Green's function method predicted analogous electromomentum coupling in piezoelectric metamaterials. Here, we develop a simpler scheme for fibrous piezoelectric composites undergoing antiplane shear waves. We employ a source-driven approach that delivers a unique set of effective properties for arbitrary frequency–wavevector pairs. We numerically show how the resultant homogenized model recovers exactly the dispersion of free waves in the composite. We also compute the effective properties in the long-wavelength limit and off the dispersion curves, and show that the resultant model satisfy causality, reciprocity and energy conservation. By contrast, we show how equivalent models that neglect the electromomentum coupling violate these physical laws.

Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Matthew Suss.