MECHANICAL ENGINEERING STUDENT SEMINAR

Thursday, September 22 2022 at 10:00, D. Dan and Betty Kahn Building, Auditorium 1.

Stealth waves in compound piezoelectric structures

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Surface acoustic waves (SAW) are stress waves that propagate on the surface of a solid medium. SAW devices are used in many applications, such as ultrasonic actuators and devices for micro particle manipulation. These devices are made from a piezoelectric layer, on top of which interdigitated electrodes (IDEs) are deposited. When the IDEs are subjected to a harmonic voltage, at a specific frequency related to the spatial pitch between the IDEs, surface waves are induced due to the inverse piezoelectric effect.

In this research we investigate the notion of *stealth waves*. In common SAW devices, the waves propagate over the same surface over which the IDEs are defined. In contrast, stealth waves propagate predominantly over the *free surface* that is *opposite* to the surface with the IDEs. In this work we demonstrate that stealth waves may occur in multi-layered compound structures. We demonstrate this in a structure made of a $LiNbO_3$ layer, bonded to a Single Crystalline Silicon (SCS) substrate. We examine the effect of geometrical and physical properties, on the stealth waves that may be induced in the compound structure, and present optimal design parameters.

Stealth waves may have technological advantages. For example, in ultrasonic actuators, it may be advantageous to have the waves propagate over a surface that is free of IDEs and of their electric connectors. If the surface with the driven IDEs is free of any deformations, then it may be bonded to a fixed solid substrate, thus providing protection and passivation to the IDEs. SAW devices are also used to manipulate fluids and suspensions in BIO-MEMS chips. By moving the IDEs away from the surface waves, we may eliminate unwanted effects of electrostatic field interaction with the fluids and suspensions.

Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Matthew Suss.