MECHANICAL ENGINEERING MSc SEMINAR (30 min.)

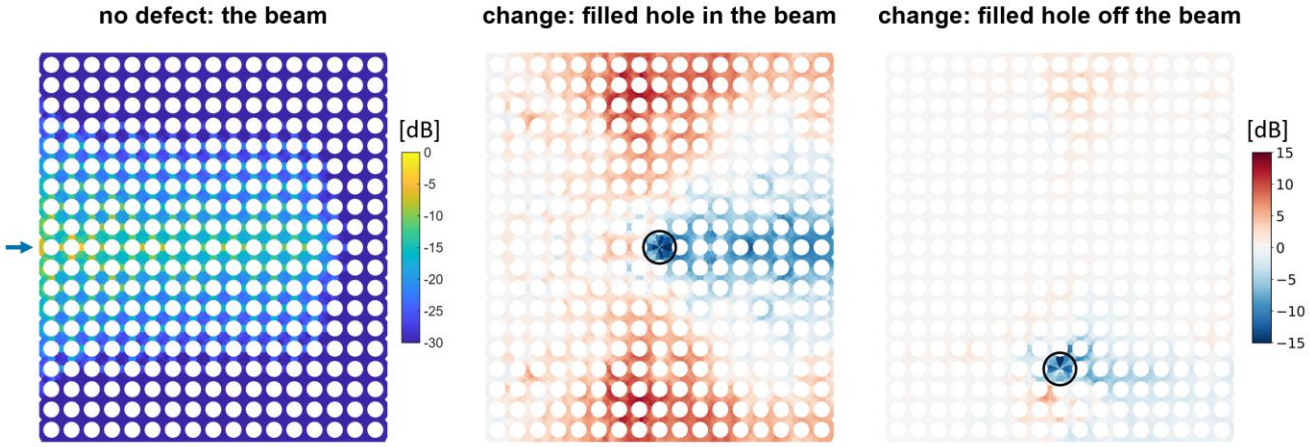
Thursday, November 12, 2026, at 13:30-14:00, D. Dan & Betty Kahn Building, Auditorium 1

Band-Gap Design and Wave Directivity in Perforated Plates

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Adviser: Prof. Izhak Bucher

Periodic structures, built by repeating a single unit cell in space, can be designed to control how elastic waves propagate. Their dispersion relation, obtained from one cell through Bloch's theorem, reveals band gaps: frequency ranges in which no wave can travel. This research examines whether this wave control can detect defects inside a lattice. The first idea is to excite the structure inside a band gap. There, the intact lattice is quiet, so a locally scattering defect stands out. A perforated steel plate was designed so its band gap contains the operating band of an air-coupled transducer. Transient simulations of the finite plate confirm the gap: inside it, the wave decays within the first few columns of cells, and the plate's far edges stay much quieter than a solid plate. A crack inside the lattice does trap a localized vibration at gap frequencies, but it is detectable from the edges only when it lies close to the measured edge. This motivates a second approach: guiding energy toward the defect in narrow beams. The plate's directivity is computed from iso-frequency contours of its dispersion surfaces. Energy flows normal to these contours, and beams form where the contour curvature, obtained analytically, vanishes. Each beam is characterized by its mix of longitudinal, shear-horizontal and shear-vertical motion and by its coupling to the transducer. Inside the in-plane band gap, only antisymmetric waves propagate, so the plate also filters the wave type. Simulations show that a defect on a beam changes the plate's response, while a defect off the beam hardly does. Future work includes measuring the printed plate and searching for defects with beams.



Seminars Coordinator: Prof. Sefi Givli

Note: the seminar will be given in Hebrew