



MECHANICAL ENGINEERING MSc SEMINAR (30 min.)

Wednesday, December 25 2025 at 14:00-14:30, Lady Davis Building, Room 250

Visualization and control of acoustic levitation using model-based Schlieren imaging

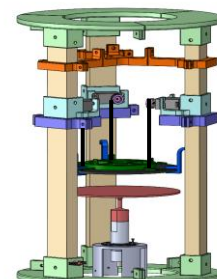
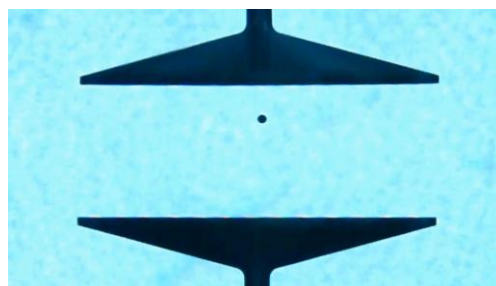
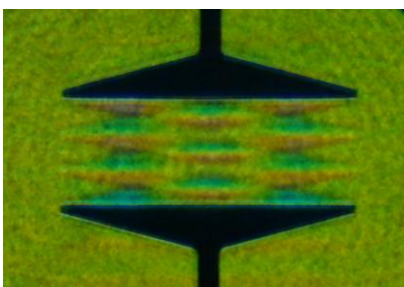
Yaron Zinger

Adviser: Prof. Izhak Bucher

This seminar presents a method for visualizing the ultrasonic acoustic field under which particles can be levitated in the air and their position can be controlled. Acoustic levitation leverages the nonlinear behavior of compressible fluids, where sinusoidal excitation creates spatially fixed static pressure and local potential wells. Particles can be suspended in mid-air within these wells without physical contact. This research aims to improve the understanding of how to move these potential wells in a controlled manner. To better control and shape the acoustic field, it is essential to understand its three-dimensional distribution of pressure. It appears that state-of-the-art numerical modeling cannot account for key factors at these high frequencies, including viscous effects, streaming, reflections, and unmodeled nonlinear behavior.

By combining background-oriented Schlieren (BOS) imaging with the stroboscopic effect, the projection of an acoustic field in an experimental system can be obtained. Controlling the relative phase between two transducers demonstrates that a particle can be moved vertically within an axisymmetric pressure distribution. The asymmetrical acoustic field can be reconstructed from a single projection via Abel's inversion. Adjusting the upper transducer's tilting angle shows that a particle can be moved sideways. Although the pressure distribution is non-axisymmetric in this case, it can still be recovered using the inverse Radon transformation.

The method further analyzes periodic pressure changes and distinguishes between standing and traveling waves, as levitation is supported only by the former. An extensive experimental campaign validates this approach.



Note: the seminar will be given in Hebrew