University of Rochester

Department of Biomedical Engineering
Colloquium

Mohamed Ghanem, Ph.D.

Senior Research Scientist

Center for Industrial and Medical Ultrasound,
Applied Physics Laboratory, University of Washington

"Acoustic radiation force and its applications"

MARCH 26

Seminar Abstract:

Acoustic radiation forces offer a powerful, contactless means of manipulating objects across a wide range of scales and applications. This talk presents work on an acoustic forceps system that utilizes acoustic wavefields to trap, levitate, and steer objects in three-dimensional space, with emphasis on in vivo manipulation and broader applications of radiation forces.
We demonstrate the use of a 1.5 MHz focused multi-element array to manipulate kidney stone models in water bath experiments and in the urinary bladders of live pigs. Clinically relevant manipulation paths were validated experimentally in vivo, with deviations from intended trajectories averaging less than 10%. Building on these results, we present the design and fabrication of a custom 256-element array optimized to improve steering range for 2–5 mm stones under safe acoustic exposure levels.

Beyond kidney stone manipulation, we explore radiation forces for tissue engineering. Travelling waves from single-sided transducers coupled with holographic plates were designed to align particles along parallel planes, similar to those produced from a standing wavefield. Particles were suspended in 3D space over a localized region without being pushed away from the transducer, pointing toward the feasibility of in vivo cellular patterning for tissue scaffolding.
Together, these studies highlight acoustic radiation forces as a versatile tool, from navigating solid objects within the body to organizing biological matter for regenerative medicine. Work is supported by NIH K25-DK132416 and R01-EB035523.

Thursday, March 26, 2026 | 8:30am EST | Goergen Hall 101

Zoom Webinar ID: 970 5582 1926 Passcode: BME@UR

Zoom Webinar Link: https://rochester.zoom.us/j/97055821926

UNIVERSITY OF ROCHESTER, BIOMEDICAL ENGINEERING DEPARTMENT