Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL | NC STATE UNIVERSITY

Coulter Seminar Series Presents

"Imaging of Elastic Properties of Cardiovascular and Cancerous Tissues as well as Brain Therapies Using Ultrasound"

Elisa E. Konofagou, PhD

Robert & Margaret Hariri Professor of Biomedical Engineering
Professor of Radiology (Physics)
Columbia University

Elisa Konofagou is the Robert and Margaret Hariri Professor of Biomedical Engineering and Professor Radiology as well as Director of the Ultrasound and Elasticity Imaging Laboratory at Columbia University in New York City. Her main interests are in the development of novel elasticity imaging techniques and therapeutic ultrasound methods and more notably focused ultrasound in the brain for drug delivery and stimulation, myocardial elastography, electromechanical and pulse wave imaging, harmonic motion imaging with several clinical collaborations in the Columbia Presbyterian Medical Center and elsewhere. Elisa is an Elected Fellow of the American Institute of Biological and Medical Engineering, a member of the IEEE in Engineering in Medicine and Biology, IEEE in Ultrasonics, Ferroelectrics and Frequency Control Society, the Acoustical Society of America and the American Institute of Ultrasound in Medicine. She has co-authored over 240 published articles in the aforementioned fields. Prof. Konofagou is also a technical committee member of the Acoustical Society of America, the International Society of Therapeutic Ultrasound, the IEEE Engineering in Medicine and Biology conference (EMBC), the IEEE International Ultrasonics Symposium and the American Association of Physicists in Medicine (AAPM). Elisa serves as Associate Editor in the journals of IEEE Transactions in Ultrasonics, Ferroelectrics and Frequency Control, Ultrasonic Imaging and Medical Physics, and is recipient of awards such as the CAREER award by the National Science Foundation (NSF), the Nagy award by the National Institutes of Health (NIH) and the IEEE-EMBS Technological Achievement Award as well as additional recognitions by the American Heart Association, the Acoustical Society of America, the American Institute of Ultrasound in Medicine, the American Association of Physicists in Medicine, the Wallace H. Coulter foundation, the Bodossaki foundation, the Society of Photo-optical Instrumentation Engineers (SPIE) and the Radiological Society of North America (RSNA).

ABSTRACT

Elasticity imaging techniques aim at the detection of tissue abnormalities following an external, internal or inherent mechanical stimulation. By taking advantage of the additional depth information provided by ultrasound imaging, the local tissue response (i.e., displacement, strain and/or vibration amplitude) that depends on its mechanical properties can be imaged. After introducing methods for 2D and 3D strain estimation, examples will be shown on imaging of normal and pathological myocardium in finite-element models and in vivo murine, canine and human subjects. Elasticity Imaging developed by our group also expands to Pulse Wave Imaging for the characterization of atherosclerotic plaques and hypertension for the prevention of stroke. Electromechanical Wave Imaging for the assessment of the conduction properties of the myocardium and the radiation-force-based oscillatory technique of Harmonic Motion Imaging (HMI) for the characterization of breast and pancreatic tumors during tumor progression as well as chemotherapy. In the second part of this presentation, therapeutic ultrasound techniques will be introduced together with application of elasticity imaging for simultaneous monitoring of the treatment procedures. Most precisely, Focused Ultrasound (FUS) for ablation of tumors substantially modifies the tissue stiffness by up to a ten-fold in order to annihilate their function. By monitoring this stiffness change, HMI can successfully detect the temperature rise and coagulation onset during treatment. An all ultrasound-based system providing simultaneous tumor detection and treatment application as well as monitoring will be described. Finally, brain applications for drug delivery through the opening of the blood-brain barrier (BBB) for brain drug delivery in conjunction with microbubbles will be shown as it applies to Alzheimer's, Parkinson's and cancer treatment with first in human studies.

Friday, September 17th
12:00 Noon

Presented From: 321 MacNider Hall (UNC)
Videoconferenced to: 4142 Engineering Building III (NC State)