POLITECNICO
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Milano, June 19 2023

Dear Students and Colleagues,

you are kindly invited to attend the scientific seminar entitled " **Decoupling prestress and waveguide effects from elasticity estimates using dynamic elastography**" that will be given by Prof. Thomas J. Royston (University of Illinois at Chicago). The seminar will be **at 14:00 on July 6th in "Sala Giulio Natta" on the ground floor of the Departiment of Chemistry, Materials and Chemical Engineering, Giulio Natta**, building n. 6, Politecnico di Milano, Piazza Leonardo da Vinci, 32 Milano. An abstract of the seminar and a short bio of prof. Royston are provided in the next page.

After the seminar, professor Royston will be available for a Question-and-Answer session with student and academic staff on the Double Degree Program for Biomedical Engineering between the Politecnico di Milano and the Univsersity of Illinois at Chicago (see attached leaflet).

The seminar and the Q&A session will be given live with simultaneous streaming on-line at the webex page https://politecnicomilano.webex.com/meet/pasquale.vena

Best regards

Pasquale Vena,

Enrico Caiani,

Marco Domenico Santambrogio

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Decoupling prestress and waveguide effects from elasticity estimates using dynamic elastography

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Abstract

Dynamic elastography methods – using noninvasive optical, ultrasonic or magnetic resonance imaging modalities – aim to quantitatively map shear viscoelastic properties of materials. These properties in biological tissues are altered by disease and injury, as well as response to therapy, and so accurate measurement of them can be a useful biomarker in assessing pathology and tracking therapeutic response. When considering larger regions of interest, like the liver or brain, boundary (waveguide) effects may be negligible. But, as elastography is clinically applied to other anatomical regions where dimensions in at least one direction are smaller or of comparable length to bulk shear wavelengths – such as in slender skeletal muscles, blood vessels, the heart wall and the cornea – waveguide effects become non-negligible and must be considered. Additionally, inherent to their function, these same tissues operate under nonzero quasi-static prestress conditions. Both small dimensions and prestress will affect mechanical wave motion independently of changes in material viscoelastic properties. For elastography to reach its full diagnostic potential, it should be able to "correct" for waveguide effects while also differentiating changes in measured mechanical wave motion caused by altered tissue properties from changes caused by altered prestress (loading) conditions on the tissue, since different pathologies will affect tissue properties and loading conditions in different ways. This is a tall order, even without another curve ball; most of these tissues possess an organized fiber structure that results in a direction-dependence of their viscoelastic properties. In this talk, I will review these challenges, focusing on skeletal muscle and the cornea, and propose a framework to address them that has shown promise in numerical simulation studies and experimental studies on phantoms with idealized geometry. I will conclude by summarizing challenges ahead of us as we take our framework in vivo and into the clinic.

Bio

Tom Royston, Ph.D., Professor and Head of Biomedical Engineering at the University of Illinois Chicago (UIC), earned his PhD in Mechanical Engineering from the Ohio State University in 1995. He has been a faculty member at UIC since 1995, with appointments in Biomedical Engineering and Mechanical Engineering, and head of Biomedical Engineering since 2009. Tom's NIH and NSF-supported research in mechanical wave motion and imaging in porous and nonporous viscoelastic materials, and acoustics applied to medical diagnostics and therapy has been recognized with the NSF Career Award, the NIH NIBIB Nagy Award and the Acoustical Society of America (ASA) Lindsay Award. He is a Fellow of the ASA, the American Society of Mechanical Engineers (ASME), and the American Institute for Medical and Biological Engineering. He has served as associate editor for journals of the ASA and ASME, and has authored over 100 peer-reviewed journal articles, and 200 additional conference and other publications. Over the past 8 years he has co-advised 12 students from Politecnico Di Milano Biomedical Engineering participating in the dual MS degree program with UIC.