A School of Engineering Seminar

Measuring Stiffness and Damping of the Human Body's Suspension System in Nanoscale

SF STATE

Mojtaba Azadi

Massachusetts Institute of Technology

(Mechanical Engineering faculty candidate)

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1:10-2:00pm

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Refreshments will be served – come join us!

Synopsis:

Osteoarthritis, which affects at least 20 percent of young and old adults in the United States, leads to deterioration of cartilage, the rubbery tissue that covers the ends of bones in joints and prevents bones from rubbing together. Similar to a car's suspension system that withstand both static and dynamic loading, cartilage withstands static loads due to standing as well as dynamic loads caused by walking, running, hopping and jumping.

A car's suspension system is characterized by the stiffness of their springs and damping of their shock absorber/dashpots. In spite of the fact that changes due to osteoarthritis affect the damping of the cartilage first, only cartilage stiffness is usually characterized due to complexity of the tissue itself, required instrumentations and lack of reliable damping measurement technique. For these reasons, very different stiffness values with several order of magnitude differences are also reported in the literature. This has limited the usefulness and consistency of the output measures between labs.

We have developed a high-bandwidth dynamic technique that reliably measures the stiffness as well as the damping of the cartilage in micro and nano scale. This system has enabled us to collect novel information for the first time and to study the effect of aging and excessive running as well as role of molecules and genes in the cartilage. In this talk, the developed high-bandwidth dynamic technique and some of the findings will be discussed.

Speaker Bio:

Mojtaba Azadi is a research scientist at MIT where he works at the Center for Biomedical Engineering. His experience over the past nine years as Research Scientist at MIT, MIT Senior/Postdoctoral Associate, and PhD candidate at University of Alberta has been in the areas of biomechanics, mechatronics, and robotics. He has taught several courses including Dynamics and Bioinstrumentation Laboratory. Prior to his PhD, Dr. Azadi had five years of full-time industrial experience in design and manufacturing, mainly in the automotive and oil and gas industries.

For inquiries, please contact Ed Cheng at ascheng@sfsu.edu