3D Printed Tissue-Mimicking Phantoms (#7339)

A technology that mimics the mechanical strain stiffening behavior of soft tissues using dual-material 3D printed meta materials

Georgia Tech inventors have developed a technology that demonstrates the feasibility of mimicking the mechanical strain stiffening behavior of soft tissues using dual-material 3D printed meta materials with micro-structured reinforcement embedded in soft polymeric matrix. Although the two base materials are strain-softening polymers, both finite element analysis and uniaxial tension tests indicate that two of those dual-material designs are able to exhibit strain-stiffening effects as a meta material. Additionally, the design parameters have an effect on the mechanical behavior of the meta materials. Whereas previous technology failed to incorporate mechanical accuracy, this system can fabricate patient specific tissue-mimicking phantoms with both geometrical and mechanical accuracies with dual-material 3D printed meta materials.

Benefits/Advantages

- Fabricates patient-specific tissue-mimicking phantoms with accurate biomechanical properties, in addition to accurate geometric properties
- Associates biomechanical properties with gender, age, and other physiological/pathological conditions of the patient

Potential Commercial Applications

- Biomechanical properties of 3D printed tissue-mimicking phantoms
- Pre-operative assessment/ Surgery Planning
- Computational model validation
- Medical device testing
- Medical education

Background/Context for This Invention

Patient specific tissue-mimicking phantoms have a wide range of biomedical applications including validation of computational models and imaging techniques, medical device testing, surgery planning, medical education, etc. Although 3D printing technologies have demonstrated great potential in fabricating patient-specific phantoms, current 3D printed phantoms are usually only geometrically accurate. Mechanical properties of soft tissues can merely be mimicked at small strain situations, such as ultrasonic induced vibration. Under large deformation, however, the soft tissues and the 3D printed phantoms behave differently. The essential barrier is the inherent difference in the stress-strain curves of soft tissues and 3D printable polymers.

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For more information about this technology, please visit:
https://industry.gatech.edu/technology/3d-printed-tissue-mimicking-phantoms