KTH SOLID MECHANICS SEMINAR; Thursday, August 9th, 13.15; KTH Solid Mechanics Seminar room

Craig J. Goergen "Cardiovascular Imaging, Modeling, and Device Development"

Cardiovascular disease is the leading cause of death and disability in the world. Non-invasive imaging and wearable technologies have become vital for the detection and monitoring of disease progression, aiding in the development of therapeutics and devices. The research highlighted in this talk describes advancements at the interface of engineering and medicine in order to better understand cardiac and vascular disease. For example, conventional ultrasound measurements are commonly based on geometric assumptions from 2D images, often yielding inaccurate results with large variability. Because of this, we have developed a respiratory- and cardiac-gated 3D echocardiography technique to reconstruct ultrasound volumes. We imaged 1) the left ventricles of healthy and infarcted mice and 2) the abdominal aortas of hyperlipidemic mice with angiotensin II-induced dissecting aneurysms using a position-controlled ultrasound transducer. ECG-gated cine loops at 1000 frames-per-second were acquired at sequential positions and temporally concatenated, generating 4D datasets. Nonlinear image registration was then utilized to calculate deformation fields and project segmented masks across the cardiac cycle and from aneurysmal vessels. The dissecting aneurysm datasets were also used to run detailed hemodynamic simulations over large portions of the abdominal vasculature that include small branching vessels. We are also developing a novel in vivo photoacoustic approaches for lipid imaging using endogenous contrast. This is of particular importance for vascular disease, including atherosclerosis, where lipid accumulation can influence plaque formation. Finally, we are working to create a wearable device that can automatically measure blood pressure and body position, wirelessly transmit the results, and identify pregnant women at risk of developing preeclampsia.

Dr. Goergen is the Principal Investigator of the Cardiovascular Imaging Research Laboratory at Purdue University. His work combines advanced engineering, imaging, and biological approaches to study a variety of cardiac and vascular diseases. With funding from the NIH, NSF, AHA, and the Gates Foundation, Dr. Goergen and his team are working to improve cardiovascular disease diagnosis, treatment, and prevention, ultimately providing patients with longer and more fulfilling lives. Dr. Goergen received a BS degree in biomedical engineering from Washington University in St. Louis and MS and PhD degrees in bioengineering from Stanford University. In graduate school, Dr. Goergen worked with the Biomedical Imaging Group at Genentech to study abdominal aortic aneurysm formation. His postdoctoral training in molecular optical imaging at Harvard Medical School focused on cardiac disease and left ventricular remodeling. He joined the faculty at Purdue University in December of 2012 and was recently named the recipient of the 2017 BMES Rita Schaffer Young Investigator Award.