PennState College of Engineering | MECHANICAL ENGINEERING

Mechanical Engineering Seminar Series

Wednesday, December 9, 2020
4:00 p.m. / via Zoom
Brindise - Zoom Meeting & Presentation Link

Melissa Brindise

Post-Doctoral Research Associate
Purdue University

Using cardiovascular flow physics to improve clinical diagnostics

ABSTRACT

The use of imaging modalities, such as MRI or ultrasound, has transformed the diagnosis and treatment of cardiovascular diseases and stroke by enabling novel flow and mechanics-based analysis of patient data. However, critical gaps exist in how to most effectively use and unlock the potential of this imaging data to inform objective and data-driven clinical decisions. As a result, interpretation of such data in practice continues to be subjective and based on heuristics, leading to high variability among healthcare practices, treatment decisions, and patient outcomes. For example, hemodynamics is known to play a critical role in the growth and rupture of cerebral aneurysms. But due to a lack of consensus on the specific flow mechanisms precipitating rupture and limitations of clinically available tools to assess aneurysm flow mechanics accurately, clinical analysis still relies solely on the size of the aneurysm to decide if surgery is necessary.

My research aims to bridge these gaps using a multi-faceted approach encompassing experiments to understand the fundamental fluid mechanics of time-varying flows, the development of new methods to improve the physiological fidelity of in-vitro studies, and the development of analysis methods to enable physics-based clinical assessments of in-vivo measurements. In this talk, I will discuss my previous research achievements and future plans involving both particle image velocimetry (PIV) studies and clinical analysis tool development for applications ranging from the evaluation of transition to turbulence in pulsatile flows to the assessment of cerebral aneurysms and heart disease using in-vivo measurements. These research efforts can play a critical role in advancing our understanding of cardiovascular disease progression as well as transforming non-invasive clinical diagnostic capabilities.

BIOGRAPHY

Melissa Brindise is currently a Post-Doctoral Research Associate in the School of Mechanical Engineering at Purdue University, as part of the Purdue-Eli Lilly strategic partnership. She received her B.S. in Aeronautical Engineering (2013) and Ph.D. in Mechanical Engineering (2019) both from Purdue University. Her research has focused on experimental fluid mechanics and particle image velocimetry (PIV) combined with methods development for clinically imaged neurovascular and cardiovascular flow analysis. Her research interests include fluid dynamics associated with cerebral aneurysms, heart disease, single ventricle defects, traumatic brain injury, and transition to turbulence in unsteady flows. She has also developed image and signal processing tools for data denoising, time-frequency analysis, unsupervised segmentation, and autonomous detection of arrhythmias. She received the American Heart Association Pre-Doctoral Fellowship in 2017 for her work on cerebral aneurysms. She also received the Lambert Teaching Fellowship (2017) and Magoon Award for Excellence in Teaching (2018).

Please direct any questions regarding this seminar to Juls R. Scott at jrk30@psu.edu.