DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING
WILLIAM MAXWELL REED SEMINAR SERIES

“Computational Modeling and Statistical Inference for Cardiovascular Digital Twins”

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Abstract:
Cardiovascular disease is the leading cause of death in the modern world and acts on multiple spatial and temporal scales. Computational models have had notable success in simulating cardiovascular function and integrating multimodal data from either pre-clinical or clinical studies. The development of subject-specific models informed by these data sources are necessary for establishing cardiovascular digital twins for clinical patient management. However, functional data (e.g., invasive hemodynamics) as well as structural imaging data are both subjected to measurement error but are necessary for model calibration and parameter inference. Thus, cardiovascular digital twins must include mathematical models of multiscale, physiological mechanisms, as well as robust statistical methods for parameter inference and uncertainty quantification. Surrogate modeling is also necessary to overcome the computational expense of these multiscale models and enable nearly real time predictions. In this talk, I will discuss innovations in image-based models of blood flow (described by partial differential equations), multiscale systems-level models of cardiac function (systems of ordinary differential equations), and the statistical tools necessary for inverse problems and uncertainty quantification in cardiovascular research. While a majority of the work will focus on pulmonary vascular and right heart function, these methods collectively build the necessary tools for developing digital twins for multiple cardiac and vascular subunits of the full cardiovascular system.

Speaker Bio:

Dr. Mitchel J. Colebank is a Postdoctoral Researcher in the Department of Biomedical Engineering and the Cardiovascular Innovation and Research Center at the University of California, Irvine in Irvine, CA. He obtained his BS degree from Clemson University and his PhD from North Carolina State University. His research uses computational modeling and statistical techniques in combination with clinical and experimental data to investigate the mechanisms of cardiovascular biomechanics and disease progression. He received an American Heart Association Predoctoral Fellowship in 2019 and is supported by a NIH Translational Science (TL-1) Postdoctoral Fellowship at UC, Irvine.

Date: Wednesday, January 31, 2024
Place: Whitehall Classroom Building 110
Time: 3:00 PM EST
Contact: Dr. Jonathan Wenk

Attendance open to all interested persons

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