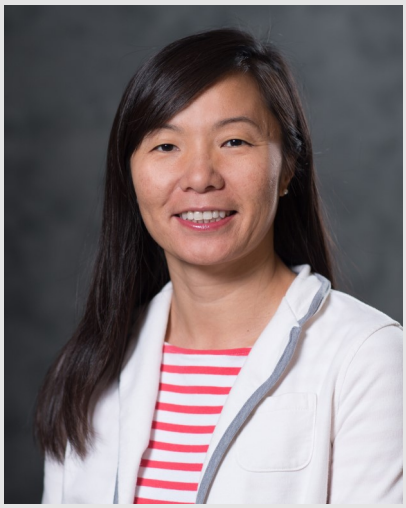
MAE Seminar SERIES

THURSDAY,
MARCH 14
3:30 PM



Dr. Lucy Zhang

Associate Professor (Ph.D., M.S., B.S.)

Mechanical, Aerospace & Nuclear Engineering Department

Rensselaer Polytechnic Institute

TOWARD BUILDING A ROBUST COMPUTATIONAL FRAMEWORK TO SIMULATE MULTIPHYSICS AND MULTISCALE PROBLEMS

ABSTRACT

Multiphysics and multiscale problems exist in many aspects of nature and practical engineering applications. Multiphysics involve multiple physical behaviors to be coupled for an inter-related response. Multiscale problems are to couple physical models at different length or time scales in order to achieve more precise and accurate description of physical behaviors. To obtain stable, effective, and accurate coupled solutions is not trivial. Traditional methods that are available in commercial software often generate numerical instabilities. To simulate and analyze engineering applications involving multiphysics and multiscales require robust simulation strategy and computational tool. In this talk, I will present the non-boundary-fitted mesh technique used initially in the Immersed Finite Element Method (IFEM) for fluid-structure interactions. It provides a robust numerical framework that easily couples the physics of any co-existing phases and scales with overlapping meshing or grids. The immersed framework has been packaged into an open-source software, OpenIFEM, with cross-platform build, standard testing with modularity, and user documentations. Coupled with Dakota, such modular framework allows easy implementation to assess uncertainty quantification for uncertain propagation and Bayesian inference for parameters identifications. Several applications using this framework will be demonstrated, which include gas-liquid-solid (3-phase) interactions to model water volume impact on flexible structures, aeroelastic-aeroacoustic simulations of vocal fold vibrations in voice production, multiscale models of nanoparticle transport in a tumor microenvironment. Potential and future applications relevant to defense and energy will also be discussed.

BIO SKETCH

Prof. Lucy Zhang is currently an Associate Professor at the Department of Mechanical, Aerospace & Nuclear Engineering at Rensselaer Polytechnic Institute (RPI) in the US. She received her B.S. from Binghamton University in December of 1997, obtained her M.S. and Ph.D. from Northwestern University, IL in 2000 and 2003, respectively. Upon graduation, she joined Mechanical Engineering Department at Tulane as an assistant professor in July of 2003. In August 2006, she moved to Rensselaer Polytechnic Institute and was promoted to Associate Professor in 2011.

Her research interests are building advanced and robust computational tools and software for accurate and efficient multiphysics and multiscale simulations that can be used for engineering applications in biomechanics, micro and nano-mechanics, medicine, and defense projects involving impacts. She has published more than 40 highly cited peer-reviewed journals and more than 20 peer-reviewed conference papers. In 2016 she received Young Investigator Award at the International Conference for Computational Methods. Her pioneer work in developing the Immersed Finite Element Method (IFEM) had been and is still being widely used in academic engineering and scientific communities. Prof. Zhang is now developing open-source tools and technology that can conveniently and efficiently couple any existing solvers for multiphysics and multiscale simulations and analysis.

University at Buffalo
Department of Mechanical and Aerospace Engineering
School of Engineering and Applied Sciences