MME Department Seminar Series

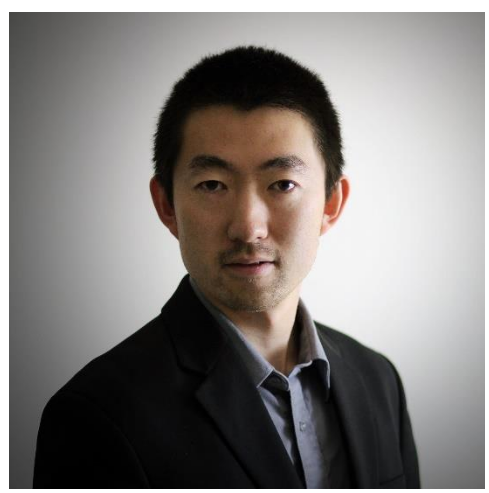
HEALTHY BUILDINGS: SCIENCE AND APPLICATION

Speaker: **Dr. Jie (Jay) Zhao**
Delos Labs, Delos, US

Theme: Thermal Engineering

Time: 2021-11-18, 4:00-5:00 pm ETD
Zoom Meeting ID: 960 9595 8972 (link)
Passcode: MME2021

Summary: We spend 90% of our time indoors. Indoor environment has a significant impact on our health and well-being. The WELL Building Standard provided us a holistic approach to quantify interventions to improve our indoor environments, so that our buildings can be a vehicle to make us healthier, happier and more productive. This presentation will introduce the framework of healthy buildings and elaborate two concepts: mental health - a behavioral modifiable risk factor and a potential disease burden and indoor air quality - an environmental modifiable risk factor. We will discuss why they are important from a scientific standpoint and how to improve them through building design and operations. We look forward to further research and innovation in this interdisciplinary field of healthy buildings.



Bio: Dr. Zhao is the Head of Delos Labs, and Executive Vice President at Delos LLC. He has 13 years of research and innovation experience in Human-building Interaction, specifically focusing on smart buildings and their impact on human health and well-being, as well as environmental sustainability. He received his PhD degree from Carnegie Mellon University, and Master's and Bachelor's degrees from Tongji University. Delos is New York City based a global wellness leader with a mission to enhance health and well-being in the spaces where we live, work, learn and play. It has offices in Canada, China, and Australia.

Please contact the host, Prof. Zhao Pan (zhao.pan@uwaterloo.ca), if any questions

MME Department Seminar Series

WALKING LIKE A ROBOT: IMPROVING HUMAN GAIT THROUGH MODELING AND SIMULATION

Speaker: **Prof. Anne Martin**

Pennsylvania State University, US

Theme: Automation and Controls

Time: 2021-12-8, 4:00-5:00 pm ETD

Zoom Meeting ID: 789 699 0683 (link)

Passcode: MME2021

Summary: While walking without falling seems trivially easy for most people, it typically becomes harder as people age. The consequences of falling also increase with age, motivating a desire to predict who is likely to fall so that preventative actions can be taken. However, despite a tremendous amount of research, we do not have good predictive measures for fall risk, in part because we lack predictive models of human walking and have generally ignored non-steady locomotion. The intermittent contacts and nonlinear nature of bipedal walking makes modeling and control of such systems challenging. By applying nonlinear, robot control theory to human gait, moderately complex models can be developed to better understand human locomotion. This talk will discuss how I have leveraged recent advances in legged robot control to develop computationally tractable, predictive models of human walking and evaluate how the percentage of time spent on two feet affects disturbance rejection capabilities. I will then compare the ability of three different system identification methods to capture the response to normal human variability. Finally, I will discuss how people transition between walking speeds.

Bio: Anne Martin is the Martin W. Trethewey Early Career Professor of mechanical engineering at the Pennsylvania State University. Prior to that, she was a postdoctoral associate in the Locomotor Control Systems Laboratory within the departments of Bioengineering and Mechanical Engineering at the University of Texas at Dallas. She received her Ph.D. in mechanical engineering from the University of Notre Dame in 2014. For her dissertation research, she received the Eli J. and Helen Shaheen Graduate School Award in Engineering, which is awarded to the top doctoral graduate in the College of Engineering. In 2009, she graduated Summa Cum Laude from the University of Delaware with a bachelor's degree in mechanical engineering. Her research interests include modeling human gait, particularly impaired human gait, and using such models to develop clinically useful interventions.

MME Department Seminar Series

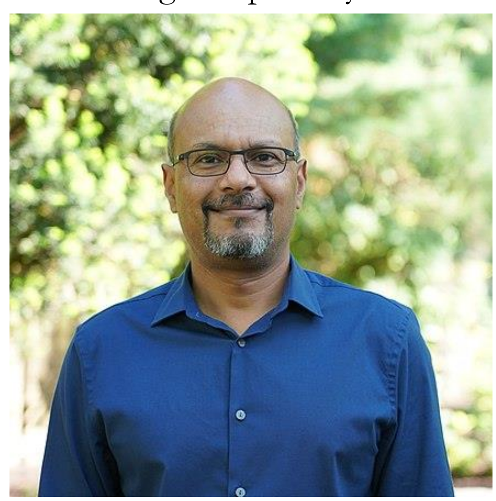
THE (UN)KNOWN-(UN)KNOWNS OF COVID-19 TRANSMISSION – A FLUID DYNAMICS PERSPECTIVE

Speaker: **Prof. Rajat Mittal**
Johns Hopkins University, US

Theme: Fluid Mechanics/Thermal Engineering

Time: 2021-10-27, 4:00-5:00 pm ETD
Zoom Meeting ID: 789 699 0683 (link)
Passcode: MME2021

Summary: COVID-19 spread across the world with a speed and intensity that laid bare the limits in our understanding of the transmission pathways of such respiratory diseases. After much confusion and misinformation, there emerged a consensus that airborne transmission from very small respiratory droplets is the most important route for the spread of COVID-19. Each stage in this transmission pathway is mediated by complex flow phenomena, ranging from air-mucous interaction inside the respiratory tract, turbulence in the exhaled jet/ambient flow, to inhalation and deposition of these aerosols in the lungs. Inspired by the Drake Equation that provides a framework to estimate the seemingly inestimable probability of advanced extraterrestrial life, I propose an intuitive model for estimating the risk of airborne transmission of a respiratory infection such as COVID-19. The model incorporates ideas from fluid dynamics with known factors involved in airborne transmission and is designed to serve not only as a common basis for scientific inquiry across disciplinary boundaries, but to also be understandable by a broad audience outside science and academia. Given the emergence of new variants and the resurgence of infections in many communities, the importance of communicating infection risk across scientific disciplines, as well as to policy/decision makers, is more important than ever.



Bio: Rajat Mittal is Professor of Mechanical Engineering at the Johns Hopkins University (JHU) with a secondary appointment in the School of Medicine. He received the B. Tech. degree from the Indian Institute of Technology at Kanpur in 1989, and the Ph.D. degree in Applied Mechanics from The University of Illinois at Urbana-Champaign, in 1995. His research interests include fluid mechanics, computing, biomedical engineering, biofluids and flow control. He is the recipient of the 1996 Francois Frenkiel Award from the Division of Fluid Dynamics of the American Physical Society, and the 2006 Lewis Moody, and the 2021 Freeman Scholar awards from the American Society of Mechanical Engineers. He is a Fellow of American Society of Mechanical Engineers and the American Physical Society, and an Associate Fellow of the American Institute of Aeronautics and Astronautics. He is associate editor of the Journal of Computational Physics, Frontiers of Computational Physiology and Medicine, and the Journal of Experimental Biology.

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MME Department Seminar Series

COMBINING ORIGAMI ART AND ENGINEERING: SURPRISING OPPORTUNITIES FOR SOCIETAL IMPACT

Speaker: **Prof. Larry L. Howell**
Brigham Young University, US

Theme: Solid Body Mechanics and Design

Time: 2021-09-23, 4:00-5:00 pm ETD
Zoom Meeting ID: 789 699 0683 (link)
Passcode: MME2021

Summary: Inspiration to create engineering systems that meet emerging needs can come from varied sources, including art. Origami artists have used the accessible and formable medium of paper to create vast numbers of designs, resulting in stunning origami structures and mechanisms that were created in a simple medium and using a single fabrication process (folding). The artists' methods and insights have led to systems that are unlikely to have been conceived using traditional engineering approaches. Origami-inspired methods are making it possible to design origami-like systems but using different materials and processes to meet emerging product requirements. This presentation will show how engineering research that combines origami art and engineering has the potential to impact applications as diverse as spacecraft, consumer products, and surgical instruments.

Bio: Larry L Howell is a Professor and an Associate Academic Vice President at Brigham Young University (BYU). He received his B.S. from BYU and M.S. and Ph.D. from Purdue University. Prior to joining BYU he was a finite element analysis consultant for Engineering Methods, and an engineer on the design of the YF-22 (the prototype for the U.S. Air Force F-22 Raptor). He is a Fellow of ASME, past chair of the ASME Mechanisms & Robotics Committee, and has been associate editor for the *Journal of Mechanisms & Robotics* and the *Journal of Mechanical Design*. He is the recipient of the ASME Machine Design Award, ASME Mechanisms & Robotics Award, Theodore von Kármán Fellowship, NSF Career Award, Purdue Outstanding Mechanical Engineer (alumni award). Prof. Howell's research focuses on compliant mechanisms, including origami-inspired mechanisms, space mechanisms, and medical devices. He is the co-editor of the *Handbook of Compliant Mechanisms* and the author of *Compliant Mechanisms*.

Check out this fun YouTube video by Veritasium on Prof. Howell and his amazing work on compliant mechanisms.

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