DEPARTMENT of INDUSTRIAL ENGINEERING
UNIVERSITY of HOUSTON

FRIDAY SEMINAR SERIES
BROADEN HORIZONS | EXTEND MINDS

Professor Jianjun Shi
The Carolyn J. Stewart Chair and Professor
School of Industrial and System Engineering
Georgia Institute of Technology

Date: Friday, March, 24, 2023

Time: 1 - 1:50 pm

Location: D2 LECT 2

Co-Evolution of Data Science and Modeling of Multistage Manufacturing Processes

Abstract: A multistage manufacturing process (MMP) refers to a manufacturing system consisting of multiple machines, stations, or operations to finish a final product. The quality of the final product is a result of complex interactions among multiple stages. In other words, the quality characteristics of one stage are not only influenced by local variations at that stage but also by variations propagated from upstream stages. With the advancement of sensing and computing technologies, in-situ sensor outputs in MMP has been evolving, from univariate data to multivariate data, to functional curves, to images, to 3D point cloud data, and to high-resolution videos. At the same time, data science methods employed have also been evolving dramatically from the early time when PCA, clustering and classification, and state space models were developed, to the later time when Bayesian models and big data analysis were used, and to the most recent time when one sees the application of tensor-based models, Koopman operator theory, and numerous emerging machine learning methods. This talk will tell the story behind the research journey in the past 30 years for modeling and analysis of MMP. It will discuss the co-evolution of sensing technologies and data science, and how their evolution drives and propels the advancement in modeling and analysis of MMP, how those methodological developments models provide bases in addressing fundamental issues in variation modeling, tolerance synthesis, distributed sensing, root cause diagnosis, and error compensation for system variation reduction; how those R&D efforts motivated by real engineering problems. This presentation provides a summary of major milestones in modeling and analysis of MMP, how it evolved with sensing and data science, and where it was implemented. Some ideas about future research directions will be discussed as well.

Biography: Dr. Jianjun Shi is the Carolyn J. Stewart Chair and Professor in H. Milton Stewart School of Industrial and Systems Engineering, with joint appointment in the George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology. Prior to joining Georgia Tech in 2008, he was the G. Lawton and Louise G. Johnson Professor of Engineering at the University of Michigan. He received his B.S. and M.S. in Electrical Engineering from the Beijing Institute of Technology in 1984 and 1987, and his Ph.D. in Mechanical Engineering from the University of Michigan in 1992.

Dr. Shi is a pioneer in the development and application of data fusion for quality improvements. His methodologies integrate system informatics, advanced statistics, and control theory for the design and operational improvements of manufacturing and service systems by fusing engineering systems models with data science methods. He has produced 40 Ph.D. graduates, 27 of which have joined IE department as faculty members. Among them, 7 have received NSF CAREER Awards and one has received the NSF PECASE award. He has published one book and more than 180 papers. He has served as PI and co-PI for projects totaling more than 25 million dollars, which were funded by National Science Foundation, NIST Advanced Technology Program, Department of Energy, General Motors, Daimler-Chrysler, Ford, Boeing, Lockheed-Martin, Honeywell, Pfizer, Samsung, and various other industrial companies and funding agencies. The technologies developed in Dr. Shi's research group have been widely implemented in various production systems with significant economic impacts.

Dr. Shi is the founding chair of the Quality, Statistics and Reliability (QSR) Subdivision at the Institute for Operations Research and Management Science (INFORMS). He has served as the Editor-in-Chief of the IISE TRANSACTIONS (2017-2020), the flagship journal of the Institute of Industrial and Systems Engineers. He also served as the Focus Issue Editor of IISE Transactions on Quality and Reliability Engineering (2007-2017), editor of J. System Science and Complexity, and advisory editor of J. Quality Technology and Quantitative Management (QTQM). He is a Fellow of American Society of Mechanical Engineering (ASME), a Fellow of the Institute of Industrial and Systems Engineering (IISE), a Fellow of Institute of Operations Research and the Management Science (INFORMS), a Fellow of Society of Manufacturing Engineering (SME), an Academician of the International Academy for Quality, and a member of National Academy of Engineering (NAE) of the USA.

Dr. Shi received various awards for his research and teaching, including the George Box Medal (2022), ASQ Walter Shewhart Medal (2021), The S. M. Wu Research Implementation Award (2021), ASQ Brumbaugh Award (2019), The Horace Pops Medal Award (2018), IISE David F. Baker Distinguished Research Award (2016), the IIE Albert G. Holzman Distinguished Educator Award (2011), Forging Achievement Award from Forging Industry Educational and Research Foundation (2007), Monroe-Brown Foundation Research Excellence Award (2007), the 1938E Award (1998) at The University of Michigan, and NSF CAREER Award (1996).

Faculty Host: Dr. Jiming Peng jopeng@central.uh.edu