Multi-Sensor Data Fusion for In-situ Quality Control in Smart Manufacturing

Jionghua Judy Jin

Professor
Department of Industrial and Operations Engineering
University of Michigan

Abstract: Smart manufacturing processes with distributed in-situ process sensing provides the feasibility to acquire and communicate massive process operational data during production. This provides unprecedented opportunities to achieve in-situ quality control for defects prevention and quality assurance to achieve smart manufacturing. Meanwhile, it also calls for data analytics challenges for modeling the intricate dependency of products quality on massive in-situ sensing signals. This presentation will discuss the related data analytics methods, which include the use of a general high-order tensor data structure to preserve the spatial and temporal dependency for multi-stream functional signals and image data; an improved multilinear discriminant analysis for automatic feature extraction and classification of tensor data for sensor fusion and process fault diagnosis; and a general functional regression model for predicting quality responses based on the massive mixed types of process sensing data including images and functional waveform signals as well as scalar process setup parameters. Some real world applications will also been discussed.

Bio: Dr. Jionghua (Judy) Jin is currently a professor in the Department of Industrial and Operations Engineering and the Director of Manufacturing Program at the University of Michigan. Dr. Jin's research focuses on data fusion and analytics in quality engineering with broad applications in both manufacturing and service industries. She has received numerous awards including the prestigious NSF CAREER Award in 2002 and the presidential PECASE Award in 2004, respectively and 14 Best Paper Awards. She is currently the Editor of Quality and Reliability Engineering for IISE Transactions. She was also the former Vice President of INFORMS in 2010~2013 and the President of Quality Control and Reliability Engineering Division in IIE in 2007~2008. She is an elected Fellow of IISE and ASME, ISI, and a senior member of ASQ.
She received her BS and MS in Mechanical Engineering at Southeast University, Nanjing, China in 1984 and 1987, and her PhD in Industrial and Operations Engineering at the University of Michigan in 1999, respectively.