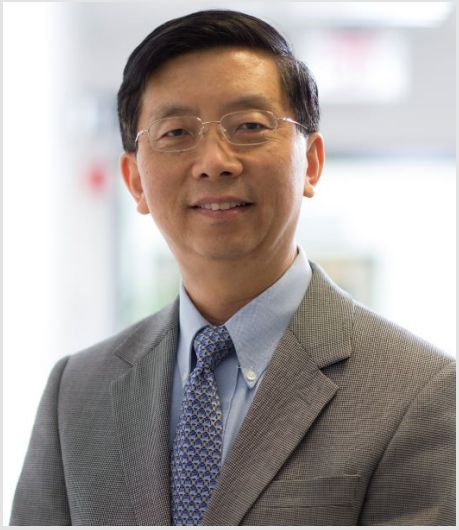
MAE *Seminar* SERIES

DISTINGUISHED SPEAKER

THURSDAY, MAY 2

3:30 PM

114 HOCHSTETTER HALL



Dr. Robert Gao

Professor (Ph.D., M.S., B.S.), Department Chair, Mechanical & Aerospace Engineering, Case Western Reserve University

MULTI-PHYSICS SENSING AND DATA ANALYTICS FOR ENHANCED MANUFACTURING PROCESS MONITORING

ABSTRACT

Sensors monitor production operations in real-time, often in harsh environment, and provide input for diagnosing the root cause of quality degradation and fault progression such that corrective measures can be formulated and executed to control a machine's deviation from its optimal operational state. With the increasing convergence among measurement science, data analytics, wireless communication, and system miniaturization, advanced sensing methods has continually contributed to enabling functionalities that were previously not feasible, leading to smart manufacturing. New sensors not only acquire higher resolution data at faster rates, but also provide local computation for autonomously analyzing the acquired data for intelligent decision support.

This talk highlights research on multi-physics sensing methods for improved observability in manufacturing process monitoring, using polymer injection molding as a case study. The design, characterization, and realization of a multivariate sensor with acoustic-based data transmission capability for data transmission in a RF-shielded environment, together with advanced computational methods, are described. Experiments performed on a production grade injection molding machine demonstrate that a single multivariate sensor can outperform multiple commercial sensors in predicting the quality attributes of injection molded parts. The talk highlights the significance of integrating physics-based sensing with data analytics for advancing the science base and state-of-the-technology to fully realize the potential of smart manufacturing.

BIO SKETCH

Robert Gao is the Cady Staley Professor of Engineering and Department Chair of Mechanical and Aerospace Engineering at Case Western Reserve University (CWRU) in Cleveland, Ohio. He was previously the Pratt & Whitney Chair Professor of Mechanical Engineering at the University of Connecticut. Since receiving his Ph.D. degree from the Technical University of Berlin, Germany in 1991, he has been working on physics-based sensing methods, design, modeling, and characterization of instrument systems, stochastic modeling and machine learning techniques for improving the observability of dynamical systems such as manufacturing equipment and processes to understand the underlying physical mechanisms and predicting performance degradation, for ultimately improving process and product quality control.

Prof. Gao is a Fellow of the ASME, IEEE, SME, and CIRP (International Academy for Production Engineering), and an elected member of the Connecticut Academy of Science and Engineering. He was a Distinguished Lecturer of the IEEE Instrumentation and Measurement Society and Electron Devices Society. He was the lead guest editor for the Special Issue on Data Science-Enhanced Manufacturing of the ASME Journal of Manufacturing Science and Engineering, and served as Associate Editor for journals of the IEEE, ASME, and IFAC. He supervised approximately 40 PhD and MS students to their graduation, holds 12 patents, published two books and over 350 technical papers, including 150 journal articles. He is a recipient of multiple honors and awards, including the SME Eli Whitney Productivity Award, ASME Blackall Machine Tool and Gage Award, ISFA Hideo Hanafusa Outstanding Investigator Award, IEEE Instrumentation and Measurement Society Technical Award, IEEE Transactions on Instrumentation and Measurement Outstanding Associate Editor Award, multiple Best Paper and Best Student Paper awards, Outstanding Faculty Awards, and the NSF Early CAREER award.

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