Department of Systems Engineering and Engineering Management

Seminar Series

Engineering Driven Data Fusion for Manufacturing System Modeling and Performance Improvement

Dr. Jianjun Shi
(Georgia Institute of Technology, USA)

Date:	05 March, 2012 (Wed)
Time:	3:00pm (Tea reception at 2:45pm)
Venue:	B6619 (SEEM/MBE Conference Room)

Abstract

Engineering Driven Data Fusion for Manufacturing System Modeling and Performance Improvement Jianjun Shi, Georgia Institute of Technology The rapid advancements of sensors, sensor networks and computing technologies have resulted in both temporally and spatially dense data-rich environments in manufacturing systems. With massive data readily available, there is a pressing need to develop advanced methodologies and software to intelligently extract knowledge and to reveal inherent relationships among events in order to meet various decision making objectives such as monitoring, detection, diagnosis and control. Addressing the need is considered very challenging because of a collection of factors such as the complexity of the manufacturing system, the uncertainty, heterogeneity and high dimensionality of the data, and the increasing expectation and requirements on the decision-making capabilities. A unified approach of engineering-driven data fusion methods are needed to integrated statistical data analysis methods with engineering domain knowledge in manufacturing system modeling and analysis.

Motivated by this, this presentation presents a reconfigured piecewise linear regression tree (PLRT) to model the interrelationships among those variables and reduce the variation through feedforward control in a multistage wafer manufacturing process. A PLRT is one of effective approaches to model nonlinear data structure with high prediction accuracy and explicit interpretation of predictors. However, a PLRT performs well for quality prediction but not for variation reduction. An engineering-driven reconfiguration method is proposed to construct an engineering compliant model. The model complexity is further reduced with the constraint of the control accuracy requirement. We illustrate the procedure and effectiveness of the proposed method in a multistage wafer manufacturing process.

The presentation is based on collaborative research work with Dr. Ran Jin at Virginia Tech.

About the Speaker

Dr. Jianjun Shi is the Carolyn J. Stewart Chair Professor at H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology. Prior to joining the Georgia Tech in 2008 he was the G. Lawton and Louise G. Johnson Chair Professor of Engineering, Professor of Department of Industrial and Operations Engineering, and Professor Department of Mechanical Engineering at the University of Michigan. He got his B.S. and M.S. in Electrical Engineering at the Beijing Institute of Technology in 1984 and 1987 respectively, and his Ph.D. in Mechanical Engineering at the University of Michigan in 1992.

Professor Shi's research interests focus on system informatics and control for the design and operational improvements of manufacturing and service systems. He is one of the early pioneers in the field. He has produced 24 Ph.D. graduates (17 of them joined IE department as faculty members, 7 received NSF CAREER Awards, and one received PECASE award; 3 serves as executive/directors in industrial companies). He is currently serving as the Focus Issue Editor of IIE Transactions on Quality and Reliability Engineering, Editor, Journal of Systems Science and Complexity, Senior Editor of Chinese Journal of Institute of Industrial Engineering, and associate editor for the International Journal of Flexible Manufacturing Systems. He is a Fellow of IIE, ASME and INFORMS.

Dr. Shi has received 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 at The University of Michigan (2007), Excellence in Service Awards from IIE Transactions (2002, 2003), Robert M. Caddell Memorial Award 2001), and Best Paper Awards from Industrial Engineering Research Conference (2006), ASME International Mechanical Engineering Congress (2000), and North America Manufacturing Research Conference (2000). He has also received the NUTN Distance Education Innovation Team Award (2007) and the Sloan-C Program Profile Team Award (2006) as the co-Director of the GAME. He was the recipients of NSF CAREER Award (1996), the 1938E Award at the COE (1998) and Faculty Achievement Awards at UM (2003).

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All are welcome!

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