EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

DYNAMIC LATENT VARIABLE ANALYTICS FOR ANOMALY MONITORING OF MANUFACTURING PROCESS DATA

ABSTRACT - Although manufacturing systems collect massive data from routine operations, most control theory and practice to date have focused on data from carefully designed experiments for system identification. It is also clear that many processes exhibit poor control performance such as excessive dynamic oscillations. These undesirable performances are often masked in routine operation data of high dimensions with varying operation conditions, making the causes of anomalies hard to detect and diagnose. We further assert that routine operation data contain the situational knowledge about the process performance and abnormalities, which can be effectively mined with proper analytics tools.

In this talk we first provide a perspective on process data analytics based on latent variable modeling and machine learning. Dynamic latent variable analytics, including dynamic-inner principal component analysis and dynamic-inner canonical correlation analysis, are introduced to model high dimensional time series data to extract the most dynamic latent features. We show with an industrial case how real process data are efficiently modeled using these analytics to extract dynamic features, illustrating the point that dynamic feature extraction from process data are indispensable for process troubleshooting, visualization, diagnosis, and improvement.

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SPEAKER BIO – Dr. S. Joe Qin obtained his B.S. and M.S. degrees in Automatic Control from Tsinghua University in Beijing, China, in 1984 and 1987, respectively, and his Ph.D. degree in Chemical Engineering from University of Maryland at College Park in 1992. He is currently Director of the Center for Machine and Process Intelligence and Fluor Professor at the Viterbi School of Engineering of the University of Southern California.

Dr. Qin is a Fellow of AIChE, IEEE, and the International Federation of Automatic Control (IFAC). He is a recipient of the National Science Foundation CAREER Award, the 2011 Northrop Grumman Best Teaching award at Viterbi School of Engineering, the DuPont Young Professor Award, Halliburton/Brown & Root Young Faculty Excellence Award, NSF-China Outstanding Young Investigator Award, and recipient of the IFAC Best Paper Prize for a model predictive control survey paper published in *Control Engineering Practice.* He has served as a Senior Editor of *Journal of Process Control,* Editor of *Control Engineering Practice*, a Member of the Editorial Board for *Journal of Chemometrics*, and Associate Editor for several journals. He has published over 400 international journal papers, book chapters conference papers and presentations, delivered over 50 invited plenary or keynote speeches and over 120 invited technical seminars worldwide. He received over 12,500 Web of Science citations with an h-index of 53 and over 30,000 Google Scholar citations with an h-index of 70. Dr. Qin's research interests include data analytics, machine learning, process monitoring and fault diagnosis, model predictive control, system identification, semiconductor manufacturing control, building energy optimization, and predictive maintenance.

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