

报告三

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Data analytics and machine learning for troubleshooting of feedback controlled manufacturing plants

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Abstract: Manufacturing process systems collect and store massive amount of data from routine operations with computer control systems. The massive data provide a valuable basis for troubleshooting and diagnosis of operations and control systems. However, most control theory and practice research to date have focused on either system identification where the data are collected with carefully designed experiments or on fault detection where the normal process models are assumed to be available. It is clear that there is a gap between the well-developed theory in these areas and the lack of methods to analyze routine operation data under feedback control. These massive data are usually dynamic but are far from being fully excited. Therefore, theory and methods are needed to analyze these data where the dynamics exist only in a subspace of the high dimensional measurement space.

In this talk we first provide a historical perspective on the process data analytics based on latent variables modeling methods and machine learning, and the objectives to distill desirable components or features from measured data under routine operations. These methods are then extended to modeling high dimensional dynamic time series data to extract the most dynamic latent variables. Unlike principal component analysis where only variance is maximized for the extracted components, the dynamic latent variable methods extract dynamic components that are best predicted from their past values. We show with an industrial case study how real process data are efficiently and effectively modeled using these dynamic methods to extract features for process operations and control, leading to new perspectives on how process data are indispensable for manufacturing process troubleshooting, diagnosis, and effective control.



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 the Professor at the Viterbi School of Engineering of the University of Southern California.

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