

Thread dependent parameter estimation in multistep batch process by using similarity between threads

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In this study, we propose a method to estimate batch operation control inputs (i.e., recipe parameters), which are functions of parameters of a high order regression model. These control parameters strongly depend on the prior processing history of the feed. Hereafter, the combination of several influential factors regarding previous steps will be referred to as “thread”. Therefore, the control inputs are commonly estimated by using data from same thread (called “single-thread estimation”) using WMA or EWMA. However, insufficient and outdated data in one thread can be a serious problem. Here, we propose a method to use data from not only exactly same thread but also “similar” ones. Batch operation control parameters are non-stationary. Therefore, we use correlation between variations of each thread’s state as similarity criterion. Then we can use estimation methods considering the correlation, such as Kalman filter. Since control parameters are usually more than two, we need multivariate correlation between threads. We construct general algorithm to measure exact multivariate correlation of time-varying series and check the validity of it in various cases. Finally, new parameter estimation method based on the correlation is constructed and compared with the original one using generated data.