

Supporting Plant Operators through Multivariate Statistical Analysis of Recorded Process Data

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Process data are often perceived to be a goldmine for unraveling latent information from complex industrial process systems. This source of information is of particular importance for the detection and diagnosis of abnormal situations in the operation of such processes, which is a problem of considerable challenge that is attracting wide attention in both academe and industry. This is outlined by a number of surveys that are regularly published. For example, the US based petro-chemical industry alone could save up to \$10b per year if abnormal situations could be detected, diagnosed and appropriately dealt with. The same industry could save an additional \$20b per annum which result from the inappropriate operator responses to abnormal events. The consequences of not being able to detect such abnormal situations range from increased operational costs to costly plant shutdowns.

One of the problems of extracting information from plant databases is that such systems often present a large number of process variables, such as temperatures, pressures, flow rates, compositions, etc. which are typically sampled at a frequency of one minute, consequently creating huge archives of process data. Identifying and troubleshooting abnormal operating conditions simply by observation is a difficult one with such a large amount of data, particularly since the process variables are usually highly correlated. However, the sampled data has embedded within it information for revealing the state of process operation. The difficult issue is to extract this information from the data and to present it in a way that can be easily interpreted.

This presentation will summarize industrial as well as academic research work on statistical-based process monitoring tools over the past few decades that directly address the issue of large recorded variable sets. The strength of this technology relates to its simplicity, which is an attractive feature for its commercial exploitation. After a review of existing technology for reducing the complexity of the monitoring task at hand, the talk will concentrate on recent advances that are based on this key technology, known as multivariate statistical process control, to deal with sensitivity issues and how to remove the stringent assumptions imposed on the application of this methodology. The presentation will conclude by summarizing industrial application studies involving data from various processes in the chemical industry.