REVIEWS

多变量统计过程监控:进展及其在化学工业的应用

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摘要　Multivariate statistical process monitoring and control (MSPM&C) methods for chemical process monitoring with statistical projection techniques such as principal component analysis (PCA) and partial least squares (PLS) are surveyed in this paper. The four-step procedure of performing MSPM&C for chemical process, modeling of processes, detecting abnormal events or faults, identifying the variable(s) responsible for the faults and diagnosing the source cause for the abnormal behavior, is analyzed. Several main research directions of MSPM&C reported in the literature are discussed, such as multi-way principal component analysis (MPCA) for batch process, statistical monitoring and control for nonlinear process, dynamic PCA and dynamic PLS, and on-line quality control by inferential models. Industrial applications of MSPM&C to several typical chemical processes, such as chemical reactor, distillation column, polymerization process, petroleum refinery units, are summarized. Finally, some concluding remarks and future considerations are made.

关键词　multivariate statistical process monitoring and control (MSPM& C) fault detection and
isolation (FDI) principal component analysis (PCA) partial least squares (PLS) quality control inferential model

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Multivariate Statistical Process Monitoring and Control: Recent Developments and Applications to Chemical Industry

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Abstract Multivariate statistical process monitoring and control (MSPM&C) methods for chemical process monitoring with statistical projection techniques such as principal component analysis (PCA) and partial least squares (PLS) are surveyed in this paper. The four-step procedure of performing MSPM&C for chemical process, modeling of processes, detecting abnormal events or faults, identifying the variable(s) responsible for the faults and diagnosing the source cause for the abnormal behavior, is analyzed. Several main research directions of MSPM&C reported in the literature are discussed, such as multi-way principal component analysis (MPCA) for batch process, statistical monitoring and control for nonlinear process, dynamic PCA and dynamic PLS, and on-line quality control by inferential models. Industrial applications of MSPM&C to several typical chemical processes, such as chemical reactor, distillation column, polymerization process, petroleum refinery units, are summarized. Finally, some concluding remarks and future considerations are made.

Key words multivariate statistical process monitoring and control (MSPM&C); fault detection and
isolation (FDI); principal component analysis (PCA); partial least squares (PLS); quality
control; inferential model

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