Series Editors' Foreword

The series *Advances in Industrial Control* aims to report and encourage technology transfer in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. New theory, new controllers, actuators, sensors, new industrial processes, computer methods, new applications, new philosophies…, new challenges. Much of this development work resides in industrial reports, feasibility study papers and the reports of advanced collaborative projects. The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination.

Statistical process control was probably the first complete process-monitoring paradigm. It was conceived to detect when process plant conditions had changed and process outputs were no longer meeting the desired product specifications. The underlying science of statistical process control was based on Gaussian statistical analysis and principles and the method also involves tools designed to uncover or diagnose the source of the detected process change. These diagnostic tools include methods such as "cause and effect" analysis and the associated fishbone charts; however, diagnosing the cause of process change was found to be a much more difficult problem than simply identifying that process change had occurred.

In the context of closed-loop control system assessment, the seminal work of Harris and co-workers (1989) initiated new practical methods of determining whether process control loops are well tuned. A key motivation for this work was to answer the question often raised by industrial engineers of how to find out (efficiently and economically) whether any of the thousands of PID control loops present in a typical industrial plant are poorly tuned and need to be retuned. To achieve this, the solutions proposed exploited the extensive on-line data that process computers now store routinely for future analysis. Process control equipment and software vendors enthusiastically took up the approaches developed and quite a few controller assessment products are now available commercially. Academic researchers also found performance assessment to be a fruitful area of investigation and the *Advances in Industrial Control* monograph series published the work of Biao Huang and Sirish Shah as *Performance Assessment of Control Loops* (ISBN 978-1-85233-639-4, 1999). More recent contributions to this field were published in the series as the contributed volume, *Process Control Performance Assessment: From Theory to Implementation* with Andrzej Ordys, Damian Uduehi, and Michael Johnson as Editors (ISBN 978-1-84628-623-0, 2007).

Along with this good progress in process controller assessment methods, researchers have also been investigating techniques to diagnose what is causing the process or control loop degradation. This requires the use of on-line data to identify faults *via* new diagnostic indicators of typical process problems. A significant focus of some of this research has been the issue of valve problems; a research direction that has been motivated by some industrial statistics that show up to 40% of control loops having performance degradation attributable to valve problems.

Shoukat Choudhury, Sirish Shah, and Nina Thornhill have been very active in this research field for a number of years and have written a coherent and consistent presentation of their many research results as this monograph, *Data Driven Approaches for Detection and Diagnosis of Process Nonlinearities and Control Valve Problems*. The *Advances in Industrial Control* series is pleased to welcome this new and substantial contribution to the process diagnostic literature. The reader will find the exploitation of the extensive process data archives created by today's process computer systems one theme in the monograph. From another viewpoint, the use of higher-order statistics could be considered to provide a continuing link to the earlier methods of the statistical process control paradigm. Then there is the significant work presented on control valves, stiction, and plant-wide disturbances and this demonstrates important new diagnostic tools that can be used by the industrial process engineer. Finally, the volume has archival value since it brings together so many new practical results in one consistent framework. The result is a stimulating volume in the *Advances in Industrial Control* series that will be appreciated and used by industrial process control engineers, and explored further by postgraduate students and control experts from the academic controls community.

Industrial Control Centre
Glasgow
Scotland, UK
2008

M.J. Grimble
M.A. Johnson

http://www.springer.com/978-3-540-79223-9

Diagnosis of Process Nonlinearities and Valve Stiction
Data Driven Approaches
Choudhury, A.A.S.; Shah, S.L.; Thornhill, N.F.
2008, XX, 286 p. 313 illus., 115 illus. in color.,
Hardcover
ISBN: 978-3-540-79223-9