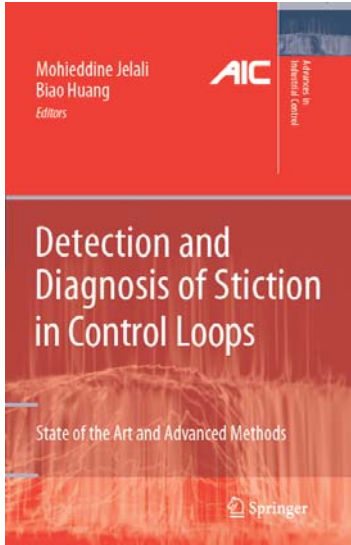


Detection and Diagnosis of Stiction in Control Loops

State of the Art and Advanced Methods



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The presence of non-linearities, such as stiction and deadband, places limits on the performance of control valves. Indeed, in the process industries, stiction is the most common valve problem, and over the last decade numerous different techniques for overcoming it have been proposed.

Detection and Diagnosis of Stiction in Control Loops represents a comprehensive presentation of these methods, including their principles, assumptions, strengths and drawbacks. Guidelines and working procedures are provided for the implementation of each method and MATLAB®-based software can be downloaded from www.ualberta.ca/~bhuang/stiction-book enabling readers to apply the methods to their own data. Methods for the limitation of stiction effects are proposed within the general context of:

- oscillation detection in control loops;
- stiction detection and diagnosis; and
- stiction quantification and diagnosis of multiple faults.

The state-of-the-art algorithms presented in this book are demonstrated and compared in industrial case studies of diverse origin – chemicals, building, mining, pulp and paper, mineral and metal processing. Industry-based engineers will find the book to be valuable guidance in increasing the performance of their control loops while academic researchers and graduate students interested in control performance and fault detection will discover a wealth of static-friction-related research and useful algorithms.

Contents: Introduction.- Part I: Stiction Modelling and Oscillation Detection.- Stiction Modelling.- An Alternative Stiction Modelling Approach and Comparison of Different Stiction Models.- Detection of Oscillating Control Loops.- Part II: Advances in Stiction Detection and Quantification.- Shape-based Stiction Detection.- Stiction Detection Based on Cross-correlation and Signal Shape.- Curve Fitting for Detecting Valve Stiction.- A Relay-based Technique for Detection of Stiction.- Shape-based Stiction Detection Using Area Calculations.- Estimation of Valve Stiction Using Separable Least-squares and Global Search Algorithms.- Stiction Estimation Using Constrained Optimisation and Contour Map.- Oscillation Root-cause Detection and Quantification Under Multiple Faults.- Comparative Study of Valve Stiction Detection Methods.- Conclusions and Future Research Challenges.- Appendices.

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