176b An Integrated Framework for Stiction Diagnosis and Compensation

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Recent surveys indicate that about 20% to 30% of all control loops oscillate due to valve problems caused by static friction or hysteresis. There have been some approaches that have been proposed for diagnosing stiction from routine operating data. Even in cases where stiction is diagnosed, the sticky valves continue to operate sub-optimally till the next production stop, which is typically between every six months to three years. The loss of product quality and energy during this intermediate period could be quite high. Stiction compensation algorithms can mitigate this problem to a large extent.

Kayihan and Doyle[1] and Hägglund[2] have reported stiction compensation algorithms for pneumatic operated control valves. The approach of Kayihan and Doyle[1] requires valve model with valve parameters (e.g. stem mass, stem length etc). Obtaining such detailed valve model information for several hundred valves will be a practical limitation. Hägglund[2] proposed a novel model-free approach called 'knocker', where a dither signal was added to the controller output (OP) to compensate stiction.

In this work, two different methodologies for stiction compensation are proposed. One of these is a heuristic approach and the other approach depends on a model built from routine operating data. The proposed approaches, for the first time, provide a framework that integrates stiction detection, quantification and compensation procedures. Stiction detection and quantification is done using two different techniques[3,4]. The stiction compensation results will be discussed on simulation case studies and also on an experimental level loop.

References

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