IMPROVING DISTURBANCE REJECTION PROPERTIES OF THE MMO METHOD

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Abstract: The PI controllers provide very good trade-off between robustness and performance. However, in certain applications the control performance of the PI controller is not sufficient. In order to increase control performance, more complicated controller structure has to be used. In this paper it has been shown that disturbance rejection properties can be significantly improved by simply adding the first-order filter within the classical PI controller structure.

Keywords: PID control, Magnitude Optimum, Frequency Response, Controller Tuning, Disturbance Rejection

1. INTRODUCTION

Tuning of PID controllers has been attracting interest for almost six decades. Numerous methods suggested so far try to accomplish the task by making use of different representations of the essential aspects of the process behaviour.

Most of the methods available so far are concentrating on improving reference tracking properties of the closed-loop. However, in chemical and process industries, a good disturbance rejection performance is often of the most importance (Åström et al., 1995; Panagopoulos et al., 1999; Vrančić and Strmčnik, 1999).

Recently, a modified method for tuning parameters of the PID types of controllers, based on the magnitude optimum method (Åström and Hägglund, 1995; Hanus, 1975; Kessler, 1955; Vrančić et al., 1999), has been developed. Namely, the original magnitude optimum (MO) tuning method aims at improving reference tracking performance, but with suitable modifications, the method can be successfully used for improving disturbance rejection performance (Vrančić and Strmčnik, 1999).

However, the PI controller, due to its structure, has a quite limited capabilities concerning disturbance rejection performance. On the other hand, the model-based controller structures can significantly improve tracking and disturbance rejection properties. However, they often have a relatively complicated structure.

In this paper it will be shown that disturbance rejection properties of the controller can be significantly improved by using the ordinary PI controller structure with additional disturbance compensation term which is realised by the first-order filter. The controller parameters of the new scheme are tuned according to the modified magnitude optimum (MMO) technique.

2. MMO TUNING METHOD

The MMO Tuning method is based on the Magnitude Optimum (MO) method developed by Kessler (1955). The classical MO method results in a relatively fast and non-oscillatory closed-loop responses for a wide range of process models (Vrančić et al., 1999). However, disturbance rejection