Study on disturbance-rejection magnitude optimum method decay ratios

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Abstract: Most PI(D) tuning methods available so far concentrate on improving tracking performance of the closed-loop. One such tuning method is the magnitude optimum (hereafter: »MO«) method [1], which results in a relatively fast and non-oscillatory system closed-loop response. The MO method is originally used for achieving superior reference tracking. On the other hand, by using the MO method, the process poles could be cancelled by the controller zeros. This may lead to poor attenuation of load disturbances if the cancelled poles are excited by disturbances and if they are slow compared to the dominant closed-loop poles [1]. Poorer disturbance rejection performance can be observed when controlling low-order processes. This is one of the most serious drawbacks of the MO method. In process control, disturbance rejection is usually more important then superior tracking [2].

Recently, a modified method for tuning parameters of PI(D) controllers, based on magnitude optimum method, has been developed. Namely, the original MO has been adjusted for improving disturbance rejection by using the so-called disturbance-rejection MO (DRMO) method [3,6]. The results were encouraging, since disturbance rejection performance has been greatly improved, especially for lower-order processes.

In this paper the DRMO is applied to a batch of process models, covering a variety of processes frequently encountered in process and chemical industries. Our intention is to show that the method in question gives controller parameters such, that in comparison with two other methods [1,4,5], the responses are relatively uniform in terms of decay ratio for most of the tested processes.

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