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Robust identification of OE model with constrained output using optimal input design

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Abstract

This paper considers the robust algorithm for identification of OE (output error) model with constrained output in presence of non-Gaussian noises. In practical conditions, in measurements there are rare, inconsistent observations with the largest part of population of observations (outliers). The synthesis of robust algorithms is based on Huber's theory of robust statistics. Also, it is known fact that constraints play a very important role in many practical cases. If constraints are not taken into consideration, the control performance can corrupt and safety of a process may be at risk. The practical value of proposed robust algorithm for estimation of OE model parameters with constrained output variance is further increased by using an optimal input design. It is shown that the optimal input can be obtained by a minimum variance controller whose reference is a white noise sequence with known variance. A key problem is that the optimal input depends on system parameters to be identified. In order to be able to implement the proposed optimal input, the adaptive two-stage procedure for generating the input signal is proposed. Theoretical results are illustrated by simulations which show significant increasing of accuracy in parameter estimates of the OE model by using the robust identification procedure in relation to the linear identification algorithm for OE models. Also, it can be seen that the convergence rate of the robust algorithm is further increased by using the optimal input design, which increases the practical value of proposed robust procedure.

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