58c An Improved Methodology to Determine the Stochastic-Based Accuracy of Data Reconciliation-Based Estimators in Linear Systems

DuyQuang Nguyen and Miguel J. Bagajewicz

Traditionally, accuracy of an instrument is defined as the sum of the precision and the bias. Recently, this notion was generalized to estimators (Bagajewicz, AIChE Journal, 2005). It is argued that the accuracy of an estimator is the sum of the precision and the maximum induced bias. This maximum induced is the maximum value of the bias of the estimator in question, that is a result of a certain specific number of biases in the network. The concept was also making use of an underlying assumption about the technique to detect biases. The paper used serial elimination using the maximum power measurement test to illustrate the concept. However, the concept ignored the frequency of failures, so in fact it was referring to a static situation ignoring temporal averages. To ameliorate this deficiency, in a recent ESCAPE 2005 paper, the definition of accuracy was modified to include expected undetected biases (as opposed to maximum values) and their frequency. The paper used Montecarlo simulations to assess the value of accuracy but it only sampled on the timing of the failure and the condition of the failure (detected or undetected). It did not sample over the size of the error, thus making assumptions about detectability that are weak. In this paper we extend the Monte Carlo simulations to also sample the size of the gross errors. Comparisons with prior work will be given.