Identifiability and Identification of Linear Time-Invariant Systems

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Identifiability is important for the applicability of a model structure. In this research, the identifiability of linear time-invariant (LTI) systems from both forced responses and initial condition responses is analyzed.

For system identifiability from forced responses, the analysis is based on constraints obtainable from measured variables for the determination of system eigenvectors. If the control matrix has *n* known independent column vectors or if all the state variables are measurable, an LTI system is found identifiable; otherwise, an LTI system is not identifiable unless some elements of the system matrix and/or the control matrix are known or related to provide an appropriate number of additional constraints.

Identifiability of LTI systems from initial condition responses is investigated according to the number of measureable state variables: one measurable state (OMS systems) or *n* measurable states (NMS systems). Analysis indicates that one initial condition response is not sufficient to uniquely determine the system matrix of an OMS system and *n* initial condition responses are necessary. The identifiability of an OMS system with data from *n* independent initial condition responses is equivalent to that of an

NMS system with only one initial condition response. Explicit formulations and a non-iterative algorithm are developed for both OMS and NMS systems.