Residual Generation from Principal Component Models for Fault Diagnosis in Linear Systems

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Part I: Review of static systems

Abstract. First some fundamental concepts of principal component analysis are summarized. This is followed by the review of our recently developed and published results on the generation of enhanced (structured) residuals from PC models, both by algebraic transformation and by direct structured modeling. Recent results on residual optimization and extensions to dynamic systems are discussed in Part II of the paper.

Part II: Extension to optimal residuals and dynamic systems

Abstract. The generation of enhanced (structured) residuals from PC models, both by algebraic transformation and by direct structured modeling, was reviewed in Part I of this paper. In Part II, some recent results on residual optimization are included. Extensions to dynamic systems are discussed. The new concept of dynamic redundancy is introduced, followed by an algorithm to simultaneously estimate the system order and the number of linear relations. The generation of enhanced (and optimized) residuals is revisited in the dynamic framework and explained in the light of dynamic redundancy. A simple example is given to illustrate the new concepts.