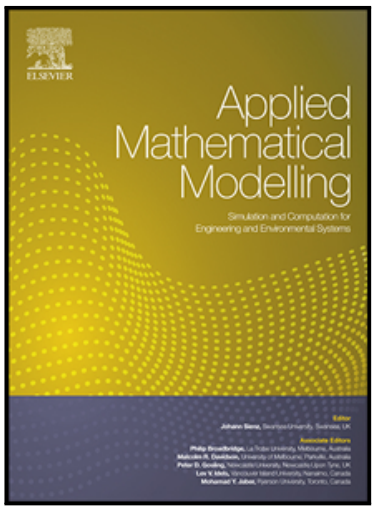

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Identification of the dynamic parametrical model with an iterative orthogonal forward regression algorithm

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Abstract

In this study, the identification of a Nonlinear Auto-Regressive with exogenous inputs (NARX) model of nonlinear systems, where the physical parameters of interest for the system design appear explicitly as coefficients in the model, is studied. The model is a dynamic parametrical model, referred as the NARX model with parameters of interest for design (NARX-M-for-D). An improved algorithm, known as the Iterative Extended Forward Orthogonal Regression (IEFOR), is proposed to identify the NARX-M-for-D of nonlinear systems. Firstly, a common-structured model, referred to as the "initial model", is established through the traditional Extended Forward Orthogonal Regression (EFOR) algorithm. Then an iterative process is applied to revise the initial model such to produce an improved model of the system, which is referred to as the "common model" in this study. Finally, functional relationships of the common model coefficients are established to determine the NARX-M-for-D of the system. Both the simulation and experimental studies are discussed to illustrate the application of the new algorithm. The results indicate that, by using the IEFOR algorithm, the established model can accurately predict the system out response and remain the merit of efficiency in computation. The new algorithm is expected to be applied in the identification of nonlinear systems in engineering practice.

Keywords: Dynamic parametrical model, Identification, NARX model, Design, IEFOR algorithm

1. Introduction:

In practice, most systems can be described by using mathematical models for the purpose of analysis and design [1-3]. Basically, two types of mathematical models are employed, known as the numerical model and the physical model. The physical model is usually preferred by engineers since the physical relationship between the output response and physical characteristic

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