Abstract

Nonlinear system identification – a practical approach

There are several methods to model and control linear dynamic systems thanks to an intensive research during the last decades. Most of these problems can be investigated with standardized tools and algorithms that determine the system's impulse response. In the real world, however, the majority of the systems represent – at least – weakly non-linear characteristics. Also, there isn't any common approach to handle non-linear behavior. Precision and degree of non-linearity must be tackled in practice for many components such as diodes, power amplifiers, and sensors.

The primary aim of this work is to find and deeply examine methods that can be used for the identification of the inverse of a weakly non-linear dynamic system, which must be performed to minimize the distortion between the input and output signals.

The work gives an overview of the available literature, most important algorithms, structures, methods and discusses the kernel-based Volterra and the block-based Hammerstein model in depth. Methods and algorithms are investigated through MATLAB simulations and one practical application: a Brüel & Kjær 4010 Mini-Shaker. Problems arising from the implementation of theoretical models to real-world situations are highlighted and tackled.

Keywords: linearization, non-linear system identification, Hammerstein-model, Volterra-model, delayed inverse