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LAGUERRE NETWORK FOR ON-LINE SYSTEM IDENTIFICATION OF INDUSTRIAL PROCESSES

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Abstract. Non-parametric models have been successfully used to represent industrial processes. A commonly used non-parametric model for model-based predictive controllers assumes a Finite Impulse Response (FIR) structure. The appeal of FIR models lies in their simplicity, ease of use since they do not require a *priori* knowledge of process deadtime, and their straightforward extension to multi-input multi-output formulation. However, the large number of parameters they require restricts their application to off-line system identification. An alternative non-parametric formulation is desired for on-line system identification and Laguerre networks satisfy this need due to the reduced number of parameters they use. This paper presents the application of Laguerre networks in identifying processes in a Petrochemical plant.
Keywords. Non-parametric models; finite impulse response; on-line system identification; Laguerre networks.

1 Introduction

System identification is often regarded as an art full of tricks. Due to the complexity of real-world processes, applications require the use of heuristics in realizing practical solutions derived from pure mathematical models. Practical issues governing model structure, persistent excitation and finite word length memory implementation, to name a few, have to be dealt with in successfully utilizing a real-time identification package for industrial application.

The number of parameters, to be estimated, hinges on the choice of model structure. A FIR model, although simple, may require up to 50 parameters to represent a process. A Laguerre network on the other hand may require only up to 15 parameters, making it a good choice for on-line system identifications.

Laguerre models are not new. Wiener made use of orthogonal Laguerre functions to model a non-linear process (Eykhoff, 1984). Dumont and Zervos have applied Laguerre representations to adaptive control (Zervos and Dumont, 1988; Dumont and Zervos, 1986; Dumont et al., 1990). Eykhoff (1984) described Laguerre models using continuous transfer functions for system identification. Early system identification schemes relied on the orthogonality of Laguerre models to make use of cross-correlation techniques for analog implementation. Recently, Laguerre functions have been discretized and the parameters are