ABSTRACT

This work concerns with aspects of betterment of quality of parameter estimates of a CT dynamical system. The well known Poisson moment functional approach has been used for parameter estimation. It is known that, in the process of estimation of transfer functions of dynamical systems from input-output data, model error is inevitable in all real problems, mainly due to two factors, namely, presence of noise in the process data and the model simplification. In the absence model simplification, resulting error is due to noise alone and there are effective methods to remove it. However, even in the absence of noise in the process data, bias occurs due to inherent undermodelling present in a parametric model structure. This bias cannot be eliminated altogether but can be distributed suitably over frequency. Established identification methods and estimation algorithms for continuous models in the literature are rather rigid leaving little room for choice to distribute the bias. These issues have been the main motivating factors for the author to take up this work. Whole work is broadly divided into two parts. First part is devoted to develop PMF based algorithm with a view to improve the quality of parameter estimates in the presence of noise in the process data. Here, it is assumed that the system structure is known exactly. In the latter part, an attempt has been made to study factors which affect the distribution of error due to both undermodelling and measurement noise. The resulting analysis has led to development of algorithm to choose design variables in a CTM estimator to meet specific application requirements.

Among the technical features, a generalized Poisson moment functional (GPMF) has been introduced and employed in a recursive least squares algorithm. Useful guidelines for the choice of Poisson filter parameter 'λ' are obtained. A GPMF based recursive instrumental variable algorithm has been developed. Simulation results therefrom, are encouraging. A prediction based equation error algorithm using PMF has been proposed for the first time. Analysis of this algorithm has provided insights into the mechanism of minimization of the identification criterion. Numerical study has revealed the influences of different design variables on the pattern of bias distribution in frequency domain. A procedure to obtain 'good' (suboptimal) design variables for a desired bias distribution has been proposed. Concluding discussion highlights some important directions for future research.

Keywords: Generalized Poisson moment functionals, Parameter estimation, continuous-time models, τ-time-ahead prediction, Design variables, Weighting function, Bias distribution.