Simultaneous computation of model order and parameter estimation of a heating system based on particle swarm optimization for autoregressive with exogenous model

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ABSTRACT

System identification is a method used to obtain a mathematical model of a system by performing analysis of input-output behavior of the system. In system identification, the procedure can be separated into four main parts. The first part is constructing an experiment to collect the input-output data of the system. Then, based on some criteria, the model order and structure are selected. The next part is to estimate the parameters of the model. For the final part, the mathematical model is verified. In this study, a new approach called simultaneous model order and parameter estimation (SMOPE), which is based on Particle Swarm Optimization (PSO), is proposed to combine model order selection and parameter estimation in one platform. In this approach, both the model order and the parameters of the system are searched simultaneously by a particle. Similar to other PSO implementation, a number of particles are utilized in the search process. In order to realize the simultaneous search of the best model order and the associated parameters, a suitable particle representation is employed. Based on a heating system case study, it is proven that the proposed approach is superior compared to some other methods in literature.

KEYWORDS

Model order selection; Parameter estimation; Particle Swarm Optimization; System identification

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