عنوان مقاله:

Application of Bayesian Belief Networks in State and Parameter Estimation

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خلاصه مقاله:

To perform state and parameter estimation, a method is proposed which is based on Bayesian Belief Network (BBN) theory. In this method nodes of a BBN model present the parameters and state variables of the process under study. The necessary conditional probability data set associated with the model that captures correlation between pair of nodes in the model is determined by conventional BBN training procedure. Evidence propagation in the BBN model is used to update probability distribution of nodes representing un-measurable/unavailable process states and parameters. Weighted averaging of updated probability distribution is used to calculate numerical value for such states and parameters. Both model-based and data-based training are feasible. In model-based training mathematical model of the process can be used in a Monte Carlo simulation to generate conditional probability data. Data-based training utilizes process data under normal operating conditions to determine conditional probability data. A stirred tank heater is used to explain how the proposed method can be applied to perform state and parameter estimation. To demonstrate effectiveness and capabilities of the proposed method, state and parameter estimation Tennessee Eastman Process is checked by using it for two processes. The first process is a simple temperature control system and the other is a part of Tennessee Eastman Process (its reactor). The training data for the first process are generated by applying Monte-Carlo simulation. For the second process we generate training data from the available for Tennessee Eastman process. The results of simulations show that the proposed method has a good efficiency to estimate process parameters and state variables.

کلمات کلیدی:

state estimation; parameter estimation; Bayesian Belief Networks; Tennessee Eastman Process

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