Neural Network Based Model Predictive Control for a Steel Pickling Process

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Abstract

A multi-layer feedforward neural network model based predictive control scheme is developed for a multivariable nonlinear steel pickling process in this paper. In the acid baths three variables under controlled are the hydrochloric acid concentrations. The baths exhibit the normal features of an industrial system such as nonlinear dynamics and multi-effects among variables. In the modeling, multiple input, single output recurrent neural network subsystem models are developed using input–output data sets obtaining from mathematical model simulation. The feedforward neural network models are used to predict the state variables over a prediction horizon within the model predictive control algorithm for searching the optimal control actions via sequential quadratic programming. The proposed algorithm is tested for control of a steel pickling process in several cases in simulation such as for set point tracking, disturbance, model mismatch and presence of noise.

Biography

Paisan Kittisupakorn is a professor of Chemical Engineering at Chulalongkorn University in Bangkok, Thailand. He received his Ph.D. in Process Systems Engineering from Imperial College, University of London, United Kingdom in 1995. Since 2002, he has been awarded as an advisor for Royal Golden Jubilee Ph.D. Program with grants to support for Ph.D. students. He has also worked as an expert for National Science and Technology Development Agency, Ministry of Science and Technology, Thailand for over 8 years. Prof. Paisan currently teaches department courses in process dynamics and control, advanced process control. His research interests include advanced process control: model predictive control, adaptive control neural network modeling and control, process design and synthesis, simulation and control of batch processes, batch reactors, chemical processes with separation.