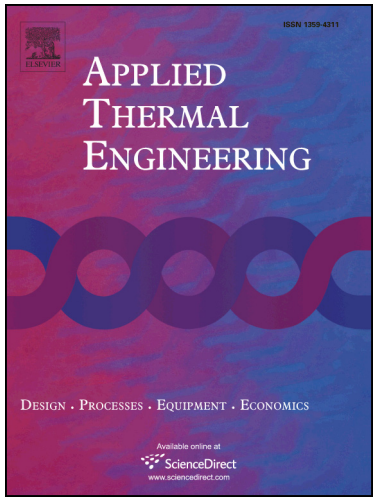

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Extended State Observer Based Fuzzy Model Predictive Control for Ultra-Supercritical Boiler-Turbine Unit

Fan Zhang[1], Xiao Wu[1], Jiong Shen[1,*]

Key Laboratory of Energy Thermal Conversion and Control of Ministry of Education, School of Energy and Environment, Southeast University, Sipailou 2, Nanjing 210096, China

Abstract

The regulation of ultra-supercritical (USC) boiler-turbine unit in large-scale power plants is vulnerable to various unknown disturbances, meanwhile, the internal nonlinearity makes it a challenging task for wide range load tracking. To overcome these two issues simultaneously, an extended state observer based fuzzy model predictive control is proposed for the USC boiler-turbine unit. Firstly, the fuzzy model of a 1000-MW coal-fired USC boiler-turbine unit is established through the nonlinearity analysis. Then a fuzzy stable model predictive controller is devised on the fuzzy model using output cost function for the purpose of wide range load tracking. An improved linear extended state observer, which can estimate plant behavior variations and unknown disturbances regardless of the direct feedthrough characteristic of the system, is synthesized with the predictive controller to enhance its disturbance rejection property. Closed-loop stability of the overall control system is guaranteed. Simulation results on a 1000-MW USC boiler-turbine

*Corresponding author

Email addresses: zhf@seu.edu.cn (Fan Zhang), wux@seu.edu.cn (Xiao Wu), shenj@seu.edu.cn (Jiong Shen)