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热工自动控制

主汽温系统模糊自适应内模控制

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摘要： 基于内模控制理论，针对火电厂主汽温被控对象的大惯性、大迟延、时变、多干扰的特点，设计了内模-比例串级控制系统，并将量子遗传算法应用于滤波器参数的寻优。并在此基础上结合T-S模糊建模和自适应控制技术，提出了模糊自适应内模控制(fuzzy adaptive internal model control，FAIMC)策略。该方案实现简单，对工况变化具有优良的适应性。对某超临界600 MW直流锅炉主汽温系统4种典型工况进行仿真控制，其过渡过程时间短，超调量小，适用于大惯性、大迟延过程的控制，控制效果明显优于串级PID控制。为克服负荷变化对主汽温系统性能的影响，采用模糊自适应内模控制策略分别进行了升降负荷实验。仿真结果表明：提出的控制系统能较好的适应对象动态模型的大幅度变化，保持较优的调节性能。

关键词： 主汽温系统 内模控制 T-S模糊建模 量子遗传算法

Fuzzy Adaptive Internal Model Control in Main Steam Temperature System

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Abstract: Based on the internal model control (IMC) principle and considered that the main steam temperature object has the properties of large inertia, large time delay, time-variation and multi-disturbances, an internal model-P cascade control system was presented. QGA was adopted to optimize the parameters of filters within IMC structure. Combining the novel algorithm, T-S fuzzy modeling and adaptive control technique, fuzzy adaptive internal model control (FAIMC) scheme is presented. The scheme was easy to be realized and has excellent adaptability to operating regime variety. The step response results under four typical operating regimes in the main temperature plant of a supercritical once-through 600 MW boiler show that the control quality of this control system is apparently superior to the general cascade PID control system. In order to get over load variety, FAIMC scheme was applied to the main steam temperature system with load increased and decreased. Simulation results show that it can adapt the large changing of dynamic model, and obtain a good regulating performance.

Keywords: main steam temperature system internal model control T-S fuzzy modeling quantum genetic algorithm

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