摘　要

近些年来，火电机组在不断向着大容量、高参数的方向发展，对于火电机组自动控制系统的要求也在不断变高。在现如今使用的一些传统控制方法，例如串级 PID 控制，对于火电机组主蒸汽温度这种非线性、大延迟、大惯性的被控对象已经无法实现很好的控制效果。动态矩阵预测控制（Dynamic Matrix Control）是一种较为高效的先进控制策略，相较于传统 PID 控制，能够拥有更高的控制效率及更稳定的控制效果。但是，因为 DMC 预测控制的计算部分为矩阵运算，较为复杂，在效率较低的工业计算机上可能无法达到如同不限计算时间的仿真结果一样的实际控制效果。

为了简化 DMC 预测控制的运算，减少其复杂程度，本文针对其最复杂的滚动优化部分，采用模糊控制器进行替代，设计的预测型模糊控制策略大大减少 DMC 预测控制运算的复杂程度。此外，本文还通过增量型策略、选择其他参数、前馈补偿三个方面对预测型模糊控制策略进行改进。

在 MATLAB 的 Simulink 仿真环境下，给出了在串级 PID 控制、DMC 预测控制、预测型模糊控制及其增量型策略、选择其他参数和前馈补偿方面改进后的主蒸汽温度控制的仿真结果，验证了预测型模糊控制策略相比于串级 PID 控制策略和 DMC 预测控制的优越性，并且对于预测型模糊控制策略的改进进行了优劣性分析。

本文研究表明，主蒸汽温度预测型模糊控制的控制效果要比串级 PID 控制明显更优，变化性输入信号下比 DMC 预测控制更优，对其进行增量型策略、选择其他参数和前馈补偿方面的改进后，能在不同侧重点上提高主蒸汽温度的控制质量。在实际工业控制过程中，可通过此方法改善主蒸汽温度的控制效果，提高火电厂机组运行的安全性和经济性。

关 键 词：主蒸汽温度；串级控制；动态矩阵控制；模糊控制

ABSTRACT

In recent years, thermal power units are developing in the direction of large capacity and high parameters, and the requirements for automatic control system of thermal power units are also increasing. Nowadays, some traditional control methods, such as cascade PID control, can not achieve good control effect for the main steam temperature of thermal power unit, which is a non-linear, large delay and large inertia controlled object. Dynamic Matrix Predictive Control (DMC) is an advanced control strategy with high efficiency. Compared with traditional PID control, DMPC has higher control efficiency and more stable control effect. However, because the calculation part of DMC predictive control is matrix operation, which is more complex, it may not be able to achieve the same actual control effect as the simulation results of unlimited computing time on industrial computers with lower efficiency.

In order to simplify the operation of DMC predictive control and reduce its complexity, a predictive fuzzy control strategy is designed to greatly reduce the complexity of DMC predictive control operation. In addition, this paper also improves the predictive fuzzy control strategy through three aspects: incremental strategy, selection of other parameters and feedforward compensation.

Under the Simulink simulation environment of MATLAB, the simulation results of the improved main steam temperature control in the aspects of cascade PID control, DMC predictive control, predictive fuzzy control and its incremental strategy, other parameters selection and feed forward compensation are given. The superiority of predictive fuzzy control strategy over cascade PID control strategy and DMC predictive control is verified, and the predictive fuzzy control is also applied to predictive fuzzy control. The improvement of control strategy is analyzed.

The research shows that the control effect of predictive fuzzy control of main steam temperature is obviously better than that of cascade PID control, and it is better than that of DMC predictive control under variable input signal. After improving its incremental strategy, selecting other parameters and feedforward compensation, the control quality of main steam temperature can be improved in different emphases. In the actual industrial control process, this method can improve the control effect of main steam temperature, and improve the safety and economy of power plant unit operation.

KEY WORDS: Main steam temperature; Cascade control; Dynamic Matrix Control; Fuzzy control