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过程系统工程

基于粒子群优化算法的球磨机制粉系统PID-ANN解耦控制器

王介生, 丛峰武, 张勇

辽宁科技大学电子信息与工程学院;辽宁科技大学材料科学与工程学院

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摘要

球团厂钢球磨煤制粉系统是多变量强耦合、时滞、非线性以及生产工况变化大的复杂对象，其自动控制问题一直是控制界关注的热点。基于粒子群算法具有对整个参数空间进行高效并行搜索的特点以及PID神经网络的自调节和自适应特性，设计了具有PID结构的多变量自适应神经网络控制器。PID神经网络解耦控制方法被用来消除回路之间的耦合，神经网络连接权值由粒子群算法进行学习优化。仿真研究表明所建模型和所提控制方法具有较好的控制品质、良好的自适应解耦能力和自学习功能。该控制策略可在大范围内克服系统的非线性和强耦合问题，具有很高的工程实用价值。

关键词

制粉系统 解耦控制技术 PID神经网络 粒子群优化算法

分类号

PID-ANN decoupling controller of ball mill pulverizing system based on particle swarm optimization method

WANG Jiesheng,CONG Fengwu,ZHANG Yong

Abstract

Ball mill coal pulverizing system of pelletizing plant is a complex nonlinear multivariable process with strongly coupling and time-delay，and its operation often varies significantly. The automatic control of such a system is a research focus in the process control area. A multivariable adaptive PID artificial neural network（ANN）controller was introduced，which was based on the characteristics of particle swarm optimization（PSO）algorithm searching the parameter space concurrently and efficiently，and the self-regulation and adaptability of PID artificial neuron networks. Decoupling control technology based on the PID-ANN was used to eliminate the coupling between loops. Particle swarm optimization algorithm was also adopted to optimize the weights of neural networks. Simulation results showed that controller method proposed had better control quality，adaptive decoupling ability and self-learning function. The new control strategy could overcome nonlinear and strong coupling features of the system in a wide range and is expected to have great potential for engineering application.

Key words

coal pulverized system decoupling control technology PID-ANN particle swarm optimization algorithm

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通讯作者 王介生 wang_jiesheng@126.com