

## 自适应粒子群优化分数阶 PID 控制器的参数整定

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**摘要:** 针对分数阶 PID 控制器参数整定较为复杂的问题, 提出了一种自适应粒子群优化 (PSO) 方法, 实现分数阶 PID 控制器参数的整定. 在该算法中首先将待整定的控制器参数的粒子种群分成 3 个子群, 并通过引入的粒子群聚集度因子和进化度因子, 分别动态调整子群的惯性权值和规模, 依据系统时域性能指标设定寻优目标函数, 通过迭代计算来实现控制器参数的整定. 最后将自适应粒子群优化分数阶 PID 控制器的方法分别应用于整数阶和分数阶被控系统进行时域性能仿真分析, 实验结果表明提出的方法能够较好地提高控制系统的性能指标, 并具有较强的抗干扰能力.

**关键词:** 分数阶 PID; 粒子群优化; 自适应; 参数整定

## Adaptive Particle Swarm Algorithm for the Parameters Tuning Offractional Order PID Controller

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**Abstract:** An parameter adaptive tuning particle swarm optimization method is proposed for the complexity of fractional order controller parameter tuning. In this algorithm, the parameter population was divided into three subpopulations, and the aggregation degree factor and the evolution speed factor are introduced in this algorithm. The individuals number and inertia weight of the subpopulations were dynamically adjusted according to the evolution speed factor and aggregation degree factor respectively, and the parameters tuning is implemented through the iteration calculation of optimization objective function. Simulation and analysis are carried on with the integral order objects model and fractional order objects model. These results show that the proposed method can provide better performance in time domain for the system and is better in the capability of anti-jamming.

**Key words:** fractional order PID controller; particle swarm optimization; self-adjusting; parameter tuning

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