

学术探讨

## 神经网络PID控制器在硬盘磁头定位系统中的应用

张洪波, 黄心汉, 彭刚

华中科技大学 控制科学与工程系, 武汉 430074

收稿日期 修回日期 网络版发布日期 2007-8-20 接受日期

**摘要** 针对硬盘驱动器难以建立准确对象模型的特性, 提出了一种采用神经网络PID控制器的方法。该方法利用神经网络的自学习能力和任意非线性表达能力, 实现实时、在线地调整PID控制器的比例、积分、微分系数, 从而找到PID控制参数的最佳组合, 以达到某种性能指标的最优化。作为常规BP神经网络的改进型, 提出以从最初时刻到当前时刻的误差的平方和最小作为性能指标函数。仿真结果表明, 采用这种控制方案进行硬盘伺服控制, 系统收敛速度快、调节时间短、且几乎没有超调和稳态误差, 性能优于常规神经网络PID控制, 适用于实际的硬盘驱动器磁头定位。

**关键词** [神经网络](#) [PID](#) [硬盘驱动器](#) [磁头定位](#)

分类号

## Application of neural network PID controller in HDD magnetic head positioning system

ZHANG Hong-bo, HUANG Xin-han, PENG Gang

Department of Control Science & Engineering, Huazhong University of Science and Technology, Wuhan 430074, China

### Abstract

In Hard Disk Drives (HDD), it is hard to establish accurate plant model. Aimed at this characteristic, this paper presents a method which applies neural network combined with PID controller. This scheme can realize real-time and on-line adjustment for proportional, integral and derivative parameters of PID controller using the capabilities of self-learning and arbitrary nonlinear expressions of neural network, as a result, contributes to finding the optimal combination of PID parameters so as to attain optimization of some performance target. As the modified style of conventional BP neural network, this paper uses the rule of minimizing total square error from initial time to current time as the performance function. The simulation results show that, applying this control scheme for HDD servo control, rapid convergent speed, short settling time, almost no overshoot as well as no steady-state error can be obtained. This method has superior to conventional one which is suitable for actual HDD magnetic head positioning.

**Key words** [Neural Network](#) [PID](#) [Hard Disk Drive](#) [magnetic head positioning](#)

DOI:

通讯作者 张洪波 [E-mail: zg\\_hongbo@sina.com](mailto:zg_hongbo@sina.com)

### 扩展功能

#### 本文信息

▶ [Supporting info](#)

▶ [PDF\(1458KB\)](#)

▶ [\[HTML全文\]\(0KB\)](#)

▶ [参考文献](#)

#### 服务与反馈

▶ [把本文推荐给朋友](#)

▶ [加入我的书架](#)

▶ [加入引用管理器](#)

▶ [复制索引](#)

▶ [Email Alert](#)

▶ [文章反馈](#)

▶ [浏览反馈信息](#)

#### 相关信息

▶ [本刊中包含“神经网络”的相关文章](#)

▶ [本文作者相关文章](#)

· [张洪波](#)

· [黄心汉](#)

· [彭刚](#)