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磁悬浮平台的解耦模糊PID控制

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摘 要：介绍差动式磁悬浮平台的结构与工作原理，建立磁悬浮平台的数学模型。采用输入输出空间变量变换实现平台3自由度的解耦，研究磁悬浮平台的模糊PID控制。该控制方法根据不同的偏差E、偏差变化率E_C对PID参数K_p，K_i和K_d进行自校正，给出了K_p，K_i和K_d的模糊规则表。实验结果表明：平台的阶跃响应超调量很小，约为6%，上升时间约为0.1 s，稳态误差约为2%；当平台被迫向下偏移0.2 mm时，系统仍能快速回到平衡位置且稳定悬浮，系统具有很好的刚度阻尼特性和鲁棒性。

关键字：模糊控制；PID控制；磁悬浮；解藕控制

Decoupling fuzzy PID control for magnetic suspended table

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Abstract: The working principle and structure of differential magnetic suspension were introduced, and the mathematical model of magnetic table was built up. The input and output space variables were used to transform achieve 3 degrees of freedom of decoupling. The fuzzy PID control plan of magnetic table was proposed and PID parameters, K_p, K_i and K_d, were accomplished self-tuning. According to different deviation E and deviation rate of change E_C, and fuzzy regular table of K_p, K_i and K_d were determined. The results show that the system overshoot of step response is very small (about 6%), the rising time is about 0.1 s, and the static error is about 2%. When the platform is deviated 0.2 mm down, the system still can fast return to the balance position and suspend stably, which shows that the system has very good stiffness and damping characteristics and robustness.

Key words:fuzzy control; PID control; magnetic suspension; decoupling control

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