在获得合适的参数时能得到较为优良的控制效果。

从以上数据可知，该 RBF-PID 比 LQR 在控制三自由度飞行器模型系统上稳态性更好、调节时间更短、鲁棒性更强。利用 ILGA 优化 RBF 神经网络的参数，避免了在设定连接权值、基函数的中心和宽度时过多的人为调整，减少了因不恰当的 RBF 网络初值设置而造成的 PID 参数调整过大的情况，提高了控制器的控制性能，具有较好的控制效果。

6 结　语

针对三自由度飞行器模型系统是一种非线性、不稳定、强耦合系统，将 RBF 网络与 PID 控制相结合，利用 RBF 网络的自学习和函数 3 逼近能力，在线调整 PID 控制器的参数，从而达到系统的稳态控制；提出一种基于免疫学习机制的遗传算法用于优化 RBF 网络参数的初值，克服了常规网络训练算法的训练时间长、易收敛到局部最优的缺点。实验结果表明，基于 RBF 网络整定的 PID 控制器有较好的自适应能力、控制精度和鲁棒性。该控制方法已成功地应用于无刷直流电机的无级调速，控制品质优于常规 PID。对于工业过程中这一类的非线性、多变量、强耦合系统，本文设计的控制策略将有较好的应用前景。

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(上接第 172 页)

5 Conclusions

An optimization based method for calculating ***GRDG*** range for process model with uncertainties (model plant mismatches) is presented and is applied in analysing various control schemes for the ALSTOM gasifier benchmark process. Reduced order linear models are identified from simulated process operating data using the output error system identification method. Model uncertainty bounds are obtained by comparing models identified under different operating conditions. The analysis reveals that the ALSTOM baseline controller is the most preferred control structure under model uncertainties. This is confirmed by simulation studies reported in the literature.

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