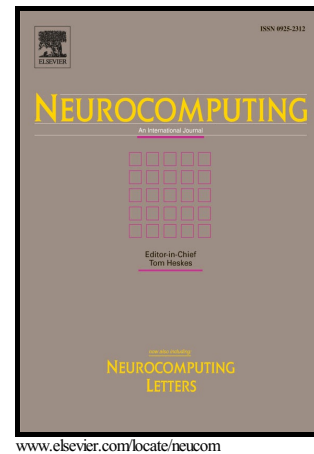


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# Adaptive fuzzy PD control with stable $H^\infty$ tracking guarantee<sup>\*</sup>

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## Abstract

For indirect adaptive fuzzy  $H^\infty$  tracking control (AFHC) of perturbed uncertain nonlinear systems, sliding-mode control (SMC) compensation usually has to be applied to ensure stability and  $H^\infty$  robustness of the closed-loop system. We prove that indirect AFHC without SMC compensation is sufficient to guarantee stable  $H^\infty$  tracking under given initial conditions and parameter constraints. The control structure only includes an indirect adaptive fuzzy control term and a proportional derivative (PD) control term. A certainty equivalent control law is slightly modified such that both a lumped perturbation and adaptive laws are independent of the PD control term. This modification is significant since it not only plays a key role in stability analysis, but also alleviates some drawbacks of existing AFHC approaches for practical applications. An illustrative example has been provided to verify correctness of the developed theoretical result.

*Key words:* Adaptive control, disturbance, neuro-fuzzy system,  $H^\infty$  tracking, nonlinear system, uncertainty.

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