Fuzzy Control for Nonlinear Time-Delay Distributed Parameter Systems under Spatially Point Measurements

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Abstract— This paper introduces a fuzzy control (FC) under spatially point measurements for nonlinear time-delay distributed parameter systems (DPSs) described by parabolic partial differential-difference equations (PDdEs). First, a Takagi-Sugeno (T-S) fuzzy PDdE model is employed to represent the nonlinear time-delay DPSs. Second, with the aid of the T-S fuzzy PDdE model, a FC design under spatially point measurements is developed in the formulation of linear matrix inequalities (LMIs) by constructing an appropriate Lyapunov functional, which can stabilize exponentially the time-delay DPSs. These stabilization conditions can be applied to either slowing-varying time delay or fast-varying one. Finally, simulation results of a numerical example are provided to illustrate the effectiveness of the proposed method.