Fuzzy-Model-Based Analysis and Design of Nonlinear Control Systems

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This lecture is concerned on the analysis and synthesis of fuzzy dynamic model-based nonlinear control systems. Firstly, we will give a brief review on our previous works on the control of fuzzy-model-based nonlinear systems described by ordinary differential equations (ODEs), including the affine nonlinear systems and non-affine nonlinear systems. Some tools such as piecewise/fuzzy Lyapunov functions, linear matrix inequalities and convexification techniques will be introduced. Secondly, we will present some recent works on fuzzy-model-based control of nonlinear hyperbolic distributed parameter systems. In particular, we consider a class of nonlinear spatially distributed systems described by first-order hyperbolic partial differential equations (PDEs). The nonlinear hyperbolic PDE systems are firstly expressed by fuzzy models with parameter uncertainties and then the objective is to design a reliable distributed fuzzy output feedback controller guaranteeing the stochastic exponential stability of the resulting closed-loop system with certain disturbance attenuation performance. Two approaches will be introduced for the controller synthesis and some simulation studies are also presented.