Analysis and Design of Robust Fuzzy Controller for Magnetic Levitation Suspension System

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ABSTRACT

Magnetic levitations suspension system is attracted and positioned in the air by electromagnetic force produced by the control of the electromagnet. However, there is nonlinear relationship between electromagnetic force and current. Besides, building a mathematics model needs some assumptions and neglects. As a result, unpredictable difference exists between the model and a real physical system. Furthermore, if we use the tradition linear control theory, the control will be limited nearby the equilibrium and will suffer from instability because of uncertain factors of the system. Therefore, we must select a controller which has good performance for a class of In this study, we choose fuzzy logic controller, but the controller is always so non-systematic and subjective. Therefore, our goal is to present a systematic design method of fuzzy controllers to achieve ∞ H optimal performance for a class of uncertain nonlinear systems. First of all, we analyzed the dynamic behavior of a product-Sum type fuzzy controller. The result reveals that this type of fuzzy controller behaves similar to a state feedback controller with non-constant feedback gains. Secondly, we want to conquer the influence of non-linear and uncertainty on the control system. We analyzed and applied the ∞ H control design technique in order to -viiattenuate the system error to a prescribed level by letting the dynamic disturbance of system non-linear characteristic to be adjusted by the parameter of the controller. In this way, we can make sure that the control system has a robust stability performance. Finally, we built a real magnetic levitation suspension system by applying the proposed fuzzy controller. As a result, the system helped us to confirm the validity and feasibility of the controller.

Keywords : nonlinear system, magnetic levitation system, fuzzy control, ∞ H control

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