H-Infinity 기법에 의한 비선형 시스템에서의 강인한 적응 관측기 설계

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Robust Adaptive Observer Design for a class of nonlinear systems via an H-infinity Approach

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Key Words: Adaptive Observer(적응 관측기), Robustness(강인성), LMI(Linear Matrix Inequality)

Abstract : Existing adaptive observers may generate parameter drift due to disturbances even if state estimation errors remain in small values. To avoid the parameter drift phenomena for nonlinear systems under bounded disturbances, several robust adaptive observers have been introduced addressing boundedness in state and parameter estimates. However, these observers may cause large estimation errors in states and parameters. In order to reduce the estimation errors due to disturbances, this paper introduces the H-infinity norm minimization problem in the adaptive observer structure, which minimizes the H-infinity norm between disturbances and estimation errors. The stability condition of the adaptive observer is reformulated as a linear matrix inequality. The observer performance is demonstrated through a numerical example.

마찰력 및 리플력 추정을 통한 X-Y 축 리니어 모터의 비선형 적응 제어

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Nonlinear Adaptive Control for a Linear-Motor-Driven X-Y Table via Estimating Friction and Ripple Forces

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Key Words: Friction Force(마찰력), Ripple Force(리플력), Cross Coupling Control(교차결합제어)

Abstract : The linear motors are easily affected by load disturbance, force ripple, friction, and parameter variations because there is no mechanical transmission to reduce the effects of model uncertainties and external disturbance. For high-speed/high-accuracy position control of a linear-motor-driven X-Y table, a nonlinear adaptive controller including a cross-coupling algorithm is designed in this paper, where the nonlinear effects such as friction and force ripple are estimated and compensated. A cross-coupling algorithm is adopted to reduce the contour error of the two-axial system. The proposed controller is evaluated through the computer simulations and then implemented using a DSP controller board. Experimental results illustrate the high performance of the proposed controller and show robustness to parameter variation.