Wavelet Robust Control by Fuzzy Boundary Layer via Time-variant Sliding Surface

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Abstract: In this paper, a new wavelet robust control by fuzzy boundary layer via time-variant sliding surface (WRCFBL) for an uncertain nonlinear system is presented. New terminologies, rejection parameter and rejection regulator, for designing a time-variant sliding surface are defined. The time variant sliding surface operates as an adaptive filter. Wavelet network is used to design an indirect controller. An adjustable control gain parameter, rejection parameter and the wavelet network coefficients are on-line tuned. Instead of saturation function a hyperbolic tangent function is used. Also, a fuzzy system that adopts absolute value of sliding surface as input and the boundary layer parameter as output is defined. This fuzzy system tunes the boundary layer width. Control system stability is guaranteed by using the Lyapunov method. The proposed method attenuates efficiently the effects of the system uncertainties and un-modelled frequencies. Also, the chattering phenomenon is completely eliminated. In addition, three theorems and one lemma, which facilitate design of the proposed controller, are proved. Also, a simulation example is presented to illustrate the performances and the advantages of the proposed method.

Keywords: robust control, wavelet networks, time-variant sliding surface, rejection regulator, fuzzy boundary layer