Wang, Hua; **Han, Zheng-Zhi**; **Xie, Qi-Yue**; **Zhang, Wei**

Finite-time synchronization of uncertain unified chaotic systems based on CLF. (English)

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Nonlinear Anal., Real World Appl. 10, No. 5, 2842-2849 (2009).

Consider the master system

$$\begin{aligned} \dot{x}_1 &= (25\alpha+10)(x_2-x_1),\\ \dot{x}_2 &= (28-35\alpha)x_1 - x_1x_3 + (29\alpha-1)x_2,\\ \dot{x}_3 &= x_1x_2 - \frac{(8+\alpha)}{3}x_3. \end{aligned} \tag{1}$$

For $\alpha \in [0,1]$ system (1) is chaotic, for certain α-values it is related to the Lorenz, Lü and Chen system. Representing (1) in the form $\dot{x} = f(x,\alpha)$, the authors consider together with (1) the slave system $\dot{y} = f(y,\alpha) + u$. The goal of the authors is to find a control u such that the slave system synchronizes the master system in finite time, that is, the corresponding error system

$$\dot{e} = \widetilde{f}(e,y,\alpha) + u \text{ with } e = y - x$$

has the property that their solutions tend to zero in a finite time. Of course, this requires that the error system is not Lipschitzian in e. The authors construct such a control by means of a control Lyapunov function. Moreover, they show that this control is robust against perturbations of some coefficients of (1).

Reviewer: Klaus R. Schneider (Berlin)

MSC:

34D06 Synchronization of solutions to ordinary differential equations
34C28 Complex behavior and chaotic systems of ordinary differential equations
34H05 Control problems involving ordinary differential equations

Keywords:

finite-time synchronization; unified chaotic systems; uncertain parameters; control Lyapunov function

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