Fractional Quadratic Nonlinearity Sprott Sliding Mode Synchronization Control of Chaotic System

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Abstract: In this paper, the fractional Quadratic nonlinear Sprott Synchronization Control of Chaotic Systems. According to the related theory of Fractional Calculus, Sufficient Conditions for synchronization of the system are obtained. The results show that: Select the appropriate control law, Fractional Order Sprott Sliding Mode Chaotic Synchronization for master-slave systems.

Keyword: Fractional Order Sprott System; Sliding Mode

1. Introduction

Chaotic Synchronization of control systems has attracted much attention in recent years. [1], With the development of Fractional Calculus, more and more scholars start to study the control and synchronization of fractional chaotic system. [2][3], Literature[4] Adaptive Sliding Mode chaotic synchronization Problem for a Class of Uncertain fractional order chaotic systems is studied. Able to synchronize the driver system with the Response System; Literature[5] Synchronization Control of Fractional-order chaotic system based on active Sliding Mode Control; Literature[6] Linear Feedback and active control method are respectively used to study two different Sprott Control and synchronization of Chaotic Systems; Literature[7] A class of simple quadratic nonlinearity is studied. Sprott Analysis and Control of chaotic system, The stability and Stability of the equilibrium point are obtained. Hopf Bifurcation; Literature[8] Adaptive Sliding Mode Terminal Control for a Class of Uncertain chaotic systems is studied. In this paper, the fractional Quadratic nonlinear Sprott Sliding Mode synchronization control and terminal control of chaotic system, Got fractional order Sprott Sufficient Condition for chaotic synchronization with Sliding Mode. Definition 1, [9] Caputo Fractional Derivative is defined

2. Fractional Order Sliding Mode Synchronization Control Problem

Ei(T)≠0: In the same way By DτE2=E1Y121X12U1; U3(T) =X121Y121E12, DτE2=|E2; So have E2(T)≠0: And DτE3=E21; U3(T) =E1,3S|GN (S(T)); By sliding mode on S(T) = 0; So SGN (S(T) = 0; And because E1E2E3≠ 0) DτE3=E1 E3(T)≠0: When state trajectory don't is located in Sliding Mode on when Select Lyapunov Function V(T) =1S(T)T V(T) =S(T)S(T); S(T) =Dτ(E1,E2,E3) S(T) =DτE1,E2,E3; V(T) =V0f -1(T) =S(T)S(T); S(T) =E1E2E3S|GN (S(T)) =|JS(T)J<0: So S(T)Is can be product of and bounded. According to Lemma 1 (Barbalat's Lemma) We can know that S(T)≠0 E3(T)≠0:
From the above analysis we can know that Error System will convergence in zero.

3. Fractional Order Sliding Mode Terminal Control Problem
Lemma 2. The assumption that there is a continuous positive definite function $V(T)$ meeting the differential inequality
\[ V(T) + \int_0^t V''(T_\sigma) P(\sigma) d\sigma \leq 0; \quad T \geq T_0; \]
where $P(T)$ is a two normal number. Then for any given $T_0; V(T)$ meets the following inequality
\[ V(T) + \int_0^t V''(T_\sigma) P(\sigma) d\sigma \leq 0; \quad T \geq T_0. \]

And $V(T) > 0$; Among them $T = T^{(V)}(T_0)$. $S(T)$ can be produced and bounded. According to Lemma 1 (Barbalat's Lemma) we can know that $S(T) > 0$. $\forall(T) > 0$.

4. Numerical Simulation

In order to ensure the correctness, we use the fourth-order Runge-Kutta method to study the numerical simulation. Theorem 1 In System Parameters select $\alpha = 0.95; \beta = 2.1; \gamma = 1.2$. Select sliding mode surface $S(T) = D^T + T^2 \cdot E^1 + T^3 \cdot E^2$, Controller $U_1(T) = 2E^2 - E^1; U_2(T) = X^2; U_3(T) = X^2 - Y^2$.

Drive System and Response System of initial value respectively is set
\[ (X_1, X_2, X_3) = (5; 3; 6; 4; 9; 2); (Y_1, Y_2, Y_3) = (8; 5; 7; 3; 6); \]

Its system of error curve as shown in Figure 1. Shown in Figure 2 respectively on don't additive with controller two conducted simulation Error System (2.3) in not sure the respective
\[ 4f_1(Y) = \cos(2\pi Y_1); 4f_2(Y) = 0.5 \cos(2\pi Y_2); 4f_3(Y) = 0.3 \cos(2\pi Y_3); \]

External disturbance take $D_1(T) = 0.2 \cos T; D_2(T) = 0.6 \sin T; D_3(T) = \cos 3T$. The initial value of Driver System and Response System
\[ (X_1, X_2, X_3) = (7); (Y_1, Y_2, Y_3) = (8); \]

Do not set $X_1; X_2; X_3$. The two simulation results of 2,3 shown, If sliding mode surface parameters take $\alpha = 3; \beta = 4; \gamma = 7$. $\forall(T) = 0.6; \forall(T) = 0.6$. Control Controller in parameters select $\alpha = 3; K_1 = 9; K_2 = 8; K_3 = 5(M^1; M^2; M^3) = (0.3; 0.5; 1)$. $\forall(T) = 0.8; 0.6; 0.3$; At this time of system error curve and simulation results as shown in Figure 4, Shown in Figure 4, see System of error soon reaching in zero.

5. Conclusion

Based on Stability Theory Study the fraction order secondary nonlinear Sprott System of Sliding Mode chaotic synchronous control and sliding mode terminal Synchronous Control Problem. And given the strict of prove Numerical simulation clear methods of effectiveness This paper Fractional Order Sliding Mode of design can be used to solve a kind of fractional order chaotic system of Sliding Mode Terminal Synchronous Control Problem.

References

