Appendix A

The matrices Ψ, Φ_1, Φ_2 and Ω in Theorem 1 are as follows:
(1) $\Psi = [\Psi^{ij}] \in \mathbb{R}^{2(p+q)\times 2(p+q)}$ where
$\Psi^{11} = P + h\frac{X+X^T}{2}$, $\Psi^{12} = hX_1 - hX$, $\Psi^{22} = -hX_1 - hX_1^T + h\frac{X+X^T}{2}$.
(2) $\Phi_1 = [\Phi_1^{ij}] \in \mathbb{R}^{3(p+q)\times 3(p+q)}$ where
$\Phi_1^{11} = \Phi_{11} - X_{\alpha|\tau(t)=0}$, $\Phi_1^{12} = \Phi_{12} + h\frac{X+X^T}{2}$, $\Phi_1^{13} = \Phi_{13} + X_{1\alpha|\tau(t)=0}$, $\Phi_1^{22} = \Phi_{22} + hU$,
$\Phi_1^{23} = \Phi_{23} - h(X - X_1)$, $\Phi_1^{33} = \Phi_{33} - X_{2\alpha|\tau(t)=0}$.
$\Phi_{11} = P_2^T\bar{A} + \bar{A}^TP_2 + 2\alpha P - Y_1 - Y_1^T$, $\Phi_{12} = P - P_2^T + \bar{A}^TP_3 - Y_2$,
$\Phi_{13} = P_2^T\bar{B}\bar{K} + Y_1^T - T$, $\Phi_{22} = -P_3^T - P_3$, $\Phi_{23} = P_3^T\bar{B}\bar{K} + Y_2^T$, $\Phi_{33} = T + T^T$,
$X_\alpha = (1 - 2\alpha(h - \tau(t)))\frac{X+X^T}{2}$, $X_{1\alpha} = (1 - 2\alpha(h - \tau(t)))(X - X_1)$,
$X_{2\alpha} = [1 - 2\alpha(h - \tau(t))](\frac{X+X^T-2X_1-2X_1^T}{2})$.
(3) $\Phi_2 = [\Phi_2^{ij}] \in \mathbb{R}^{4(p+q)\times 4(p+q)}$ where
$\Phi_2^{11} = \Phi_{11} - \frac{X+X^T}{2}$, $\Phi_2^{12} = \Phi_{12}$, $\Phi_2^{13} = \Phi_{13} + X - X_1$, $\Phi_2^{14} = hY_1^T$,
$\Phi_2^{22} = \Phi_{22}$, $\Phi_2^{23} = \Phi_{23}$, $\Phi_2^{24} = hY_2^T$, $\Phi_2^{33} = \Phi_{33} - X_{2\alpha|\tau(t)=h}$, $\Phi_2^{34} = hT^T$, $\Phi_2^{44} = -he^{-2\alpha h}U$.
(4) $\Omega = [\Omega^{ij}] \in \mathbb{R}^{3(p+q)\times 3(p+q)}$ where
$\Omega^{11} = P_2^T(\bar{A} + \bar{B}\bar{K}) + (\bar{A} + \bar{B}\bar{K})^TP_2 + \varphi Q$, $\Omega^{12} = P - P_2^T + (\bar{A} + \bar{B}\bar{K})^TP_3$,
$\Omega^{13} = P_2^T\bar{B}\bar{K}$, $\Omega^{22} = \Phi_{22}$, $\Omega^{23} = P_3^T\bar{B}\bar{K}$, $\Omega^{33} = -Q$.

Appendix B

The analysis for the behavior of $V(t)$ during $[t_k, t_k + h)$ is as follows:
The derivative of $V_1(t)$ along the trajectories of the system satisfies

$$\begin{aligned}
&\dot{V}_1(t) + 2\alpha V_1(t)\\
\leqslant\ & 2\xi^T(t)P\dot{\xi}(t) + 2\alpha\xi^T(t)P\xi(t) + (h - \tau(t))\dot{\xi}^T(t)U\dot{\xi}(t) - e^{-2\alpha h}\tau(t)\vartheta^T(t)U\vartheta(t)\\
&+ 2\alpha(h - \tau(t))\psi^T(t)[\frac{X + X^T}{2}\psi(t) + (X_1 + X_1^T)\xi(t_k)]\\
&- \psi^T(t)[\frac{X + X^T}{2}\psi(t) + (X_1 + X_1^T)\xi(t_k)] + (h - \tau(t))\psi^T(t)\frac{X + X^T}{2}\dot{\xi}(t)\\
&+ (h - \tau(t))\dot{\xi}^T(t)[\frac{X + X^T}{2}\psi(t) + (X_1 + X_1^T)\xi(t_k)]\\
&+ 2(\xi^T(t)P_2^T + \dot{\xi}^T(t)P_3^T)\big[\bar{A}\xi(t) + \bar{B}\bar{K}\xi(t_k) - \dot{\xi}(t)\big]\\
&+ 2(\xi^T(t)Y_1^T + \dot{\xi}^T(t)Y_2^T + \xi^T(t_k)T^T)\big[-\xi(t) + \xi(t_k) + \tau(t)\vartheta(t)\big]\\
=\ & \eta^T(t)\tilde{\Phi}\eta(t),
\end{aligned} \tag{1}$$

where $\vartheta(t) = \frac{1}{\tau(t)}\int_{t_k}^t \dot{\xi}(s)ds$, $\eta(t) = \mathrm{col}(\xi(t), \dot{\xi}(t), \xi(t_k), \vartheta(t))$ and $\tilde{\Phi} = [\tilde{\Phi}^{ij}] \in \mathbb{R}^{4(p+q)\times 4(p+q)}$ with
$\tilde{\Phi}^{11} = P_2^T\bar{A} + \bar{A}^TP_2 + 2\alpha P - Y_1 - Y_1^T - X_\alpha$,
$\tilde{\Phi}^{12} = P - P_2^T + \bar{A}^TP_3 - Y_2 + (h - \tau(t))\frac{X+X^T}{2}$,
$\tilde{\Phi}^{13} = P_2^T\bar{B}\bar{K} + Y_1^T - T + \frac{1}{2}(X_{1\alpha} + X_{1\alpha}^T)$,
$\tilde{\Phi}^{14} = \tau(t)Y_1^T$, $\tilde{\Phi}^{22} = -P_3^T - P_3 + (h - \tau(t))U$,
$\tilde{\Phi}^{23} = P_3^T\bar{B}\bar{K} + Y_2^T + (h - \tau(t))(-\frac{X+X^T}{2} + \frac{1}{2}(X_1 + X_1^T))$,
$\tilde{\Phi}^{24} = \tau(t)Y_2^T$, $\tilde{\Phi}^{33} = T + T^T - X_{2\alpha}$, $\tilde{\Phi}^{34} = \tau(t)T^T$, $\tilde{\Phi}^{44} = -\tau(t)e^{-2\alpha h}U$.
It follows from $\Phi_1 < 0$ and $\Phi_2 < 0$ that $\tilde{\Phi} < 0$, which implies $\dot{V}_1(t) \leqslant -2\alpha V_1(t)$ by (1). Further, one has

$$V_1(t) \leqslant e^{-2\alpha(t-t_k)}V_1(t_k), \quad t \in [t_k, t_k + h). \tag{2}$$

Appendix C

The calculations for the derivative of $V_2(t)$ along the trajectories of the system are

$$\begin{aligned}\dot{V}_2(t) &= 2\xi^T(t)P\dot{\xi}(t) + \varphi\xi^T(t)Q\xi(t) \\ &\quad + 2(\xi^T(t)P_2^T + \dot{\xi}^T(t)P_3^T)\big[(\bar{A}+\bar{B}\bar{K})\xi(t) + \bar{B}\bar{K}e(t) - \dot{\xi}(t)\big] \\ &\quad - e^T(t)Qe(t) + e^T(t)Qe(t) - \varphi\xi^T(t)Q\xi(t) \\ &= \tilde{\eta}^T(t)\Omega\tilde{\eta}(t) + e^T(t)Qe(t) - \varphi\xi^T(t)Q\xi(t), \end{aligned} \tag{3}$$

where $\tilde{\eta}(t) = \mathrm{col}(\xi(t), \dot{\xi}(t), e(t))$.

Appendix D

Considering the definition of $V_1(t)$ and $U > 0$, one has

$$\begin{aligned}V_1(t) &\geqslant \xi^T(t)P\xi(t) + (h-\tau(t))\psi^T(t)\big[\frac{X+X^T}{2}\psi(t) + (X_1+X_1^T)\xi(t_k)\big] \\ &= \frac{h-\tau(t)}{h}\zeta^T(t)\Psi\zeta(t) + \frac{\tau(t)}{h}\xi^T(t)P\xi(t), \end{aligned} \tag{4}$$

where $\zeta(t) = \mathrm{col}(\xi(t), \xi(t_k))$. Due to $\Psi > 0$ and $P > 0$, there exists ς satisfying $\Psi \geqslant \varsigma I_{2(p+q)}$ and $P \geqslant \varsigma I_{p+q}$. Then, by (4), it follows that $V_1(t) \geqslant \varsigma\|\xi(t)\|^2$. Recalling the definition of $V(t)$ and $V_2(t)$, one has $V_2(t) \geqslant \varsigma\|\xi(t)\|^2$ and $V(t_0) = \xi^T(t_0)P\xi(t_0) \leqslant \lambda_{\max}(P)\|\xi(t_0)\|^2$. Thus, it can be obtained that

$$\|\xi(t)\| \leqslant ce^{-\frac{\beta}{2}(t-t_0)}\|\xi(t_0)\|, \quad \forall t \geqslant t_0. \tag{5}$$

Appendix E

In this section, one example is presented to verify the effectiveness of the presented ETS.
Example 1. Consider the system (3) with

$$\bar{A} = \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & -2 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 & -3 \end{bmatrix}, \quad \bar{B} = \begin{bmatrix} 0 \\ 0.1 \\ 0 \\ -0.03 \\ 0 \end{bmatrix}. \tag{6}$$

A stabilizing controller is given by $\bar{K} = [2\ 15\ 400\ 200\ \ -3]$. Choose $h = 0.15$, $\varphi = 0.35$, $\alpha = 0.12$, $\beta = 0.1$, which satisfy the conditions in Theorem 1. To better illustrate the advantages, we perform the simulation for multiple initial conditions to obtain the average transmission number (ATN). Table 1 provides the comparison results on the ATNs under our ETS (4), periodic sampling, periodic ETS methods and switched ETS in [3]. We point out that the periodic sampling is achieved by choosing $\varphi = 0$, $\alpha = \beta$ in ETS (4). By comparison, our ETS (4) clearly reduces the ATN. Besides, under the initial condition $\mathrm{col}(0.98, 0, 0.2, 0, 3.8)$, the evolution of the LF of the system (3) in ETS (4) are shown by Figure 1, and the state response of the system (3) under our ETS (4), periodic sampling, periodic ETS methods and switched ETS in [3] are respectively shown by Figure 2. From Figure 1 and 2, it can be concluded that even $V(t)$ is non-monotonic, exponential stability can be maintained.

Table 1: The ATNs under different sampling methods.

	Periodic sampling	Periodic ETS	ETS in [3]	Our ETS (4)
ATN	64	58.34	56.67	45.67

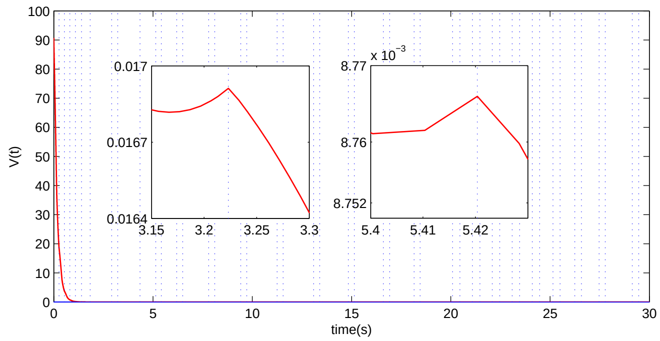

Figure 1 Evolution of the LF $V(t)$.

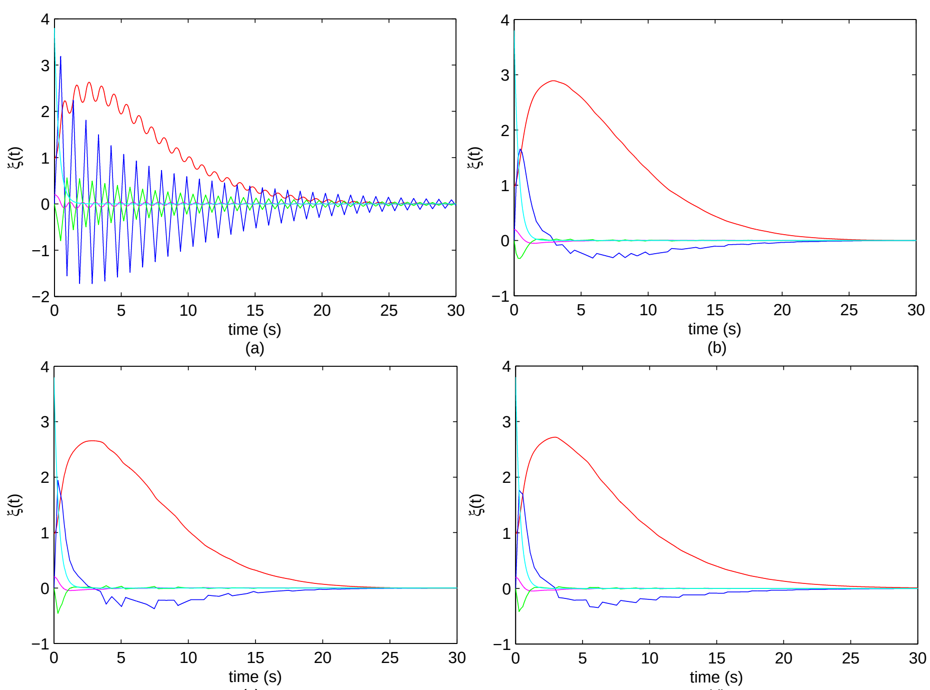

Figure 2 Figure 2 (a) State response under the periodic sampling. (b) State response under the periodic ETS. (c) State response under the switching ETS in [3]. (d) State response under the ETS (4).