EVENT-TRIGGERED SLIDING MODE OBSERVER

A. Actuator Side Implementation

$$t_{k+1}^{y} = \inf \left\{ t > t_k^{y} : \|e_y(t)\| \geqslant \sigma_a \alpha_a \right\}, \quad k \in \mathbb{Z}_{\geqslant 0}$$

$$t_0^{y} = 0 \qquad e_y(t) = \begin{bmatrix} \widetilde{C}_{11}\left(z_1(t_k^{y}) - z_1(t)\right) \\ z_2(t_k^{y}) - z_2(t) \end{bmatrix}$$

Event-based sliding mode observer:

$$\begin{aligned} \dot{\hat{z}}_1(t) &= \widetilde{A}_{11}\hat{z}_1(t) + \widetilde{A}_{12}\hat{z}_2(t) + L_1\widetilde{C}_{11}\left(z_1(t_k^{y}) - \hat{z}_1(t)\right) \\ &\quad + \widetilde{A}_{12}\left(z_2(t_k^{y}) - \hat{z}_2(t)\right) \\ \dot{\hat{z}}_2(t) &= \widetilde{A}_{21}\hat{z}_1(t) + \widetilde{A}_{22}z_2(t_k^{y}) + K\mathrm{sign}\left(z_2(t_k^{y}) - \hat{z}_2(t)\right) \\ &\quad + u(t) \end{aligned} \tag{9}$$

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$$
\begin{aligned}
\dot{\hat{z}}_1(t) &= \widetilde{A}_{11}\hat{z}_1(t) + \widetilde{A}_{12}\hat{z}_2(t) + L_1\widetilde{C}_{11}\left(z_1(t_k^y) - \hat{z}_1(t)\right) \\
&\quad + \widetilde{A}_{12}\left(z_2(t_k^y) - \hat{z}_2(t)\right) \\
\dot{\hat{z}}_2(t) &= \widetilde{A}_{21}\hat{z}_1(t) + \widetilde{A}_{22}z_2(t_k^y) + K\mathrm{sign}\left(z_2(t_k^y) - \hat{z}_2(t)\right) \\
&\quad + u(t)
\end{aligned} \tag{9}
$$

Let $e_1(t) = z_1(t_k^y) - z_1(t)$ and $e_2(t) = z_2(t_k^y) - z_2(t)$

$$
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\begin{aligned}
\dot{\hat{z}}_1(t) &= \widetilde{A}_{11}\hat{z}_1(t) + \widetilde{A}_{12}\hat{z}_2(t) + L_1\widetilde{C}_{11}\tilde{z}_1(t) + \widetilde{A}_{12}\tilde{z}_2(t) \\
&\quad + L_1\widetilde{C}_{11}e_1(t) + \widetilde{A}_{12}e_2(t) \\
\dot{\hat{z}}_2(t) &= \widetilde{A}_{21}\hat{z}_1(t) + \widetilde{A}_{22}z_2(t) + K\mathrm{sign}\left(\tilde{z}_2(t) + e_2(t)\right) \\
&\quad + u(t) + \widetilde{A}_{22}e_2(t)\,.
\end{aligned} \qquad (10)
}
$$

$$\dot{z}_1 = \widetilde{A}_{11}z_1 + \widetilde{A}_{12}z_2 \tag{3a}$$

$$\dot{z}_2 = \widetilde{A}_{21}z_1 + \widetilde{A}_{22}z_2 + u + d \tag{3b}$$

Dynamics of Estimation Error：

$$
\begin{aligned}
\dot{\tilde{z}}_1(t) &= \widetilde{A}_1\tilde{z}_1(t) - \widetilde{L}_1 e_y(t) \\
\dot{\tilde{z}}_2(t) &= \widetilde{A}_{21}\tilde{z}_1(t) - \widetilde{A}_{22}e_2(t) - K\mathrm{sign}\left(\tilde{z}_2(t) + e_2(t)\right) \\
&\quad + d(t)
\end{aligned}
$$