$$\boxed{T(\tau)\tilde{x}(t) = \tilde{x}(t+\tau)}$$

$$\begin{aligned} T(\tau) &= \begin{bmatrix} 1 & \frac{1}{1!}\tau & \frac{1}{2!}\tau^2 & \cdots \\ 0 & 1 & \frac{1}{1!}\tau & \cdots \\ 0 & 0 & 1 & \ddots \\ 0 & 0 & 0 & \ddots \end{bmatrix} \\ &= \exp(\tau\mathcal{D}) \\ \text{with } \mathcal{D} &= \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & \ddots \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} \tilde{\varepsilon}_\nu^{(1)} &= T(\tau_s)\tilde{\boldsymbol{s}}(t-\boldsymbol{\tau}_s) - \tilde{g}^{(1)}(\tilde{\mu}_x^{(1)}, \tilde{\mu}_\nu^{(1)}) \\ &= T(\tau_s - \boldsymbol{\tau}_s)\tilde{\boldsymbol{s}}(t) - \tilde{g}^{(1)}(\tilde{\mu}_x^{(1)}, \tilde{\mu}_\nu^{(1)}) \\ \dot{\boldsymbol{a}}(t) &= -(\partial_a \tilde{\varepsilon}_\nu^{(1)}) \cdot \Pi_\nu^{(1)} T(\tau_a)\tilde{\varepsilon}_\nu^{(1)}(t-\boldsymbol{\tau}_a) \\ &= -(\partial_a \tilde{\varepsilon}_\nu^{(1)}) \cdot \Pi_\nu^{(1)} T(\tau_a - \boldsymbol{\tau}_a)\tilde{\varepsilon}_\nu^{(1)}(t) \end{aligned}$$