Consider the Least Squares Algorithm (with normalization and covariance resetting)

\[ \dot{\phi} = \theta = -\gamma P w e_1 \]
\[ \dot{P} = -\gamma P w w^T P \]

\[ \gamma > 0, \quad \epsilon_0 > 0 \]

\( w \) is piecewise continuous: \( \mathbb{R}^n_+ \rightarrow \mathbb{R}^n \)

where \( k_0 > 0 \) and \( k_1 > 0 \) and,

\[ t_+^* \in \{ t \mid \lambda_{\min}(P(t)) \leq k_1^2 \} \]

Then

1. \[ \frac{e_1}{\sqrt{1 + \epsilon_0 w^T P w}} \in L^2 \cap L^{\infty} \]
2. \[ \phi \in L^{\infty} \Rightarrow \phi \in L^2 \cap L^{\infty} \]
3. \[ \beta(t) = \frac{\phi^T(t) w(t)}{1 + \|w(t)\|^2} \Rightarrow \beta \in L^2 \cap L^{\infty} \]