Homework Set # 2 [due 10-16-2013]

ENEE 765 Adaptive Control and Learning Theory

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

$$\dot{\phi} = \dot{\theta} = -\frac{\gamma P w e_1}{1 + \varepsilon_0 w^T w}$$

$$\gamma > 0 \quad \varepsilon_0 > 0$$

(w is piecewise continuous : $\mathbb{R}_+ \to \mathbb{R}^{2n}$)

$$\dot{P} = -\gamma \frac{P w w^T P}{1 + \varepsilon_0 w^T w}$$

$$P(t_0) = P(t_r^+) = k_0 \mathbb{1}$$

where $k_0 > 0$ and $k_1 > 0$ and,

$$t_r^+ \in \{ t \mid \lambda_{min}(P(t)) \le k_1 \}.$$

Then

(i) $\dfrac{e_1}{\sqrt{1 + \varepsilon_0 w^T P w}} \in L_2 \cap L_\infty$

(ii) $\phi \in L_\infty$, $\dot{\phi} \in L_2 \cap L_\infty$

(iii) $\beta(t) = \dfrac{\phi^T(t)\, w(t)}{1 + \|w(t)\|_\infty}$; $\beta \in L_2 \cap L_\infty$