Sequential parameter estimators with guaranteed accuracy for delay differential equations

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Abstract

Assume the process $(X(t); t \quad 0)$, defined by the delay differential equation

$$dX(t) = (aX(t) + bX(t \quad 1))dt + \quad dW(t)$$

and the initial condition

$$X(s) = x_0(s); s \; 2 \; [\quad 1; 0];$$

can be observed, where the parameters $\# \quad = (a; b)$ are unknown. Let be an arbitrary positive number and $q \quad 2$ fixed. A sequential estimation plan $(T \;; \hat{\#} \;)$ will be presented, such that $jj\hat{\#} \quad \#jj_q \quad ;$
where $jj{:}jj_q = (E_{\#}jj{:}jj^q)^{\frac{1}{q}}$ and $jjajj^2 = a_1^2 + a_2^2$ for $a = (a_1; a_2)$:
Asymptotic properties of $(T \;; \# \;)$ for $\; ! \; 0$ are studied.

The construction can be generalized to linear regression processes described by

$$dX(t) = \# \; a(t)dt + \quad dW(t)$$

based on observation of $(X(t); a(t); t \quad 0)$.