Assignment-5

AI1110: Probability And Random Variables
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Q Papaulis 13.9
We denote by Hs(ω) $and\ Hy(\omega), respectively$
$the\ noncausal\ estimators\ of\ the\ inputs(t)\ and$
$its\ outputy(t)\ of\ the\ system\ T(\omega)\ in\ terms\ of$
$the\ data\ x(t).\ Show\ that\ Hy(\omega) = (\omega)T(\omega).$

Solution:- *We need to show that the estimator of*

$$y(t) = \int_{-\infty}^{\infty} p(t-\alpha)s(\alpha)\,d\alpha \quad [p(t) \Longleftrightarrow T(\omega)]\ \ equals$$

$\widehat{y}(t) = \int_{-\infty}^{\infty} p(t-\alpha)\widehat{s}(\alpha)\,d\alpha$

where $\widehat{s}(t)\ is\ the\ estimator\ of\ \ s(t)$

Proof: clearly, E[s(t) - $\widehat{s}(t)]x(\xi) = 0$

Hence, E[y(t) - $\widehat{y}(t)]x(\xi) \quad all\ \ t, \xi$

= $\int_{-\infty}^{\infty} p(t-\alpha)E(s(\alpha) - \widehat{s}(\alpha)x(\xi))\,d\alpha = 0$