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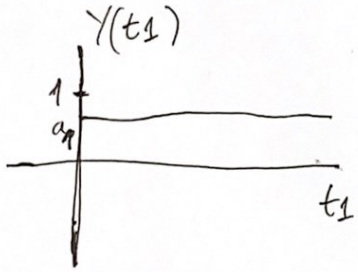
Homework #2
Estimation Theory - Prof. Suh

We have $Y(t) = X$, $X \sim U[-1, 1]$

- $E[Y(t)] = E[X] = 0 \Rightarrow E[Y(t)]$ is time invariant (1)
- $R_Y(t_1, t_2) = E[Y(t_1)Y(t_2)] = E[XX] = E[X^2]$

$$= \int_{-1}^{1} \frac{1}{2} x^2 dx = \frac{1}{6} x^3 \Big|_{-1}^{1} = \frac{2}{6} = \frac{1}{3} = R_Y(t_1 - t_2) \quad (2)$$

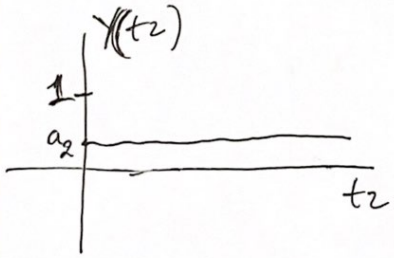
(1) and (2) $\Rightarrow$ $Y(t)$ is wide-sense stationary random process

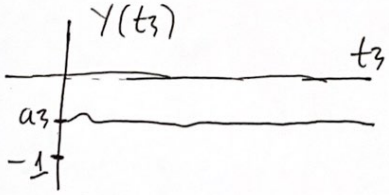


Consider $Y(t_1)$, the time average is a_1

However, the ensemble average $E[Y(t)] = 0$

$\Rightarrow$ $Y(t)$ is NOT ergodic





Autocorrelation function of $Y(t)$

$$R_Y(\tau) = E[Y(t)Y(t+\tau)] = E[X^2]$$
$$= \frac{1}{3} \text{ (computed in (2))}$$