Problem 8.12 Show that a random process that is stationary to the second order is also stationary to the first order.

Solution

Let the distribution F be stationary to second order

$$F_{X(t_1)X(t_2)}(x_1, x_2) = F_{X(t_1+\tau)X(t_2+\tau)}(x_1, x_2)$$

Then,

$$F_{X(t_1)X(t_2)}(x_1,\infty) = F_{X(t_1)}(x_1)$$

= $F_{X(t_1+\tau)X(t_2+\tau)}(x_1,\infty)$
= $F_{X(t_1+\tau)}(x_1)$

Thus the first order distributions are stationary as well.

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