

Problem 6.6

Let P_{eI} = average probability of symbol error in to the in-phase channel

P_{eQ} = average probability of symbol error in to the quadrature channel

Since the individual outputs of the in-phase and quadrature channels are statistically independent, the overall average probability of correct reception is

$$\begin{aligned} P_c &= (1 - P_{eI}) (1 - P_{eQ}) \\ &= 1 - P_{eI} - P_{eQ} + P_{eI} P_{eQ} \end{aligned}$$

The overall average probability of error is therefore

$$\begin{aligned} P_e &= 1 - P_c \\ &= P_{eI} + P_{eQ} - P_{eI} P_{eQ} \end{aligned}$$