Problem 7.5

To summarize matters, we may say that MSK is an OQPSK where the symbols in the in-phase and quadrature components (on a dibit-by-dibit basis) are weighted by the basic pulse function

$$p(t) = \sin\left(\frac{\pi t}{2T_b}\right)\text{rect}\left(\frac{t}{2T_b} - \frac{1}{2}\right)$$

where T_b is the bit duration, and rect(t) is the rectangular function of unit duration and unit amplitude. Justify this summary.

Solution

With $f_0 = \frac{1}{4T_b}$, it follows that

$$\cos(2\pi f_0 t) = \cos(\pi t/2T_b) = \sin\left[(\pi t/2T_b) + \frac{\pi}{2}\right] = \sin\left(\pi\left(\frac{t}{2T_b} + \frac{1}{2}\right)\right)$$

and

$$\sin(2\pi f_0 t) = \sin(\pi t/2T_b)$$

Following Eqs. (7.29) and (7.30), we next note that the binary waves $a_1(t)$ and $a_2(t)$, constituting the MSK signal, are extracted from the incoming binary data stream through demultiplexing and offsetting in a manner similar to OQPSK. Since $a_1(t)$ and $a_2(t)$ are themselves weighted by the sinusoidal functions $\cos(2\pi f_0 t)$ and $\sin(2\pi f_0 t)$, we may go on to state that the in-phase and quadrature components of the MSK signal are weighted (on a dibit-by-dibit basis) by the basic pulse function

$$p(t) = \sin\left(\frac{\pi t}{2T_b}\right)\text{rect}\left(\frac{t}{2T_b} - \frac{1}{2}\right)$$