Chapter 9 Digital Transmission through Bandlimited AWGN Channels (I)

Digital Transmission through Bandlimited Channels (1/3)

- A bandlimited channel such as a telephone wireline is characterized as a linear filter with impulse response $c(t)$ and frequency response $C(f)$, where

$$C(f) = \int_{-\infty}^{\infty} c(t) e^{-j2\pi ft} dt$$

- If the channel is a baseband channel that is bandlimited to B_c Hz, then $C(f)=0$ for $|f| > B_c$

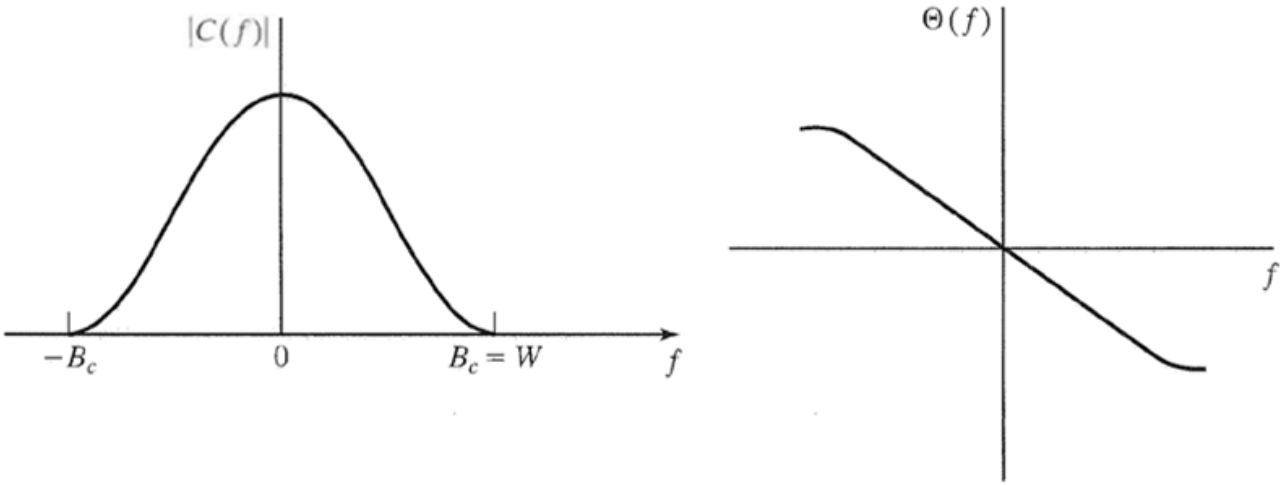

Figure 9.1 Magnitude and phase responses of bandlimited channel.

Digital Transmission through Bandlimited Channels (2/3)

- Suppose that the input to a bandlimited channel is a signal waveform $g_T(t)$. Then, the response of the channel is the convolution of $g_T(t)$ with $c(t)$, *i.e.*,

$$h(t) = \int_{-\infty}^{\infty} c(\tau) g_T(t-\tau) d\tau = c(t) \bigstar g_T(t)$$

or, when expressed in the frequency domain, we have

$$H(f) = C(f) G_T(f),$$

where $G_T(f)$ is the spectrum (Fourier transform) of the signal $g_T(t)$ and $H(f)$ is the spectrum of $h(t)$

- Thus, the channel alters or distorts the transmitted signal $g_T(t)$

Digital Transmission through Bandlimited Channels (3/3)

- Assume that the signal at the output of the channel is corrupted by AWGN. The signal at the input to the demodulator is of the form $h(t)+n(t)$, where $n(t)$ denotes the AWGN
- The linear filter channel model is shown below

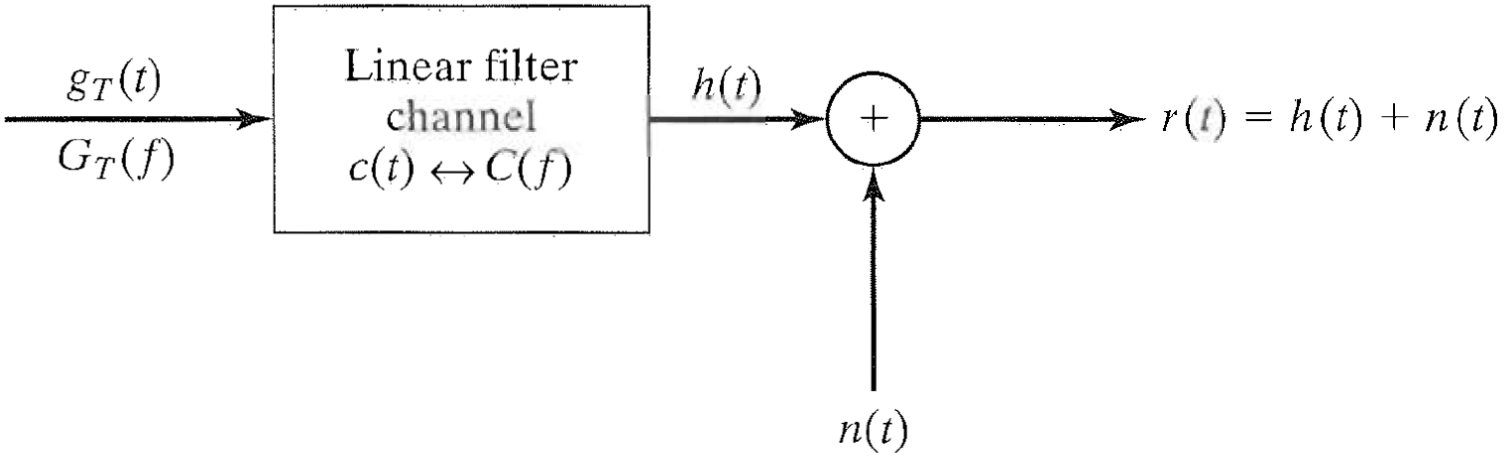

Figure 9.2 Linear filter model for a bandlimited channel.