Natural Sampling Using Pulses

Till now we have studied sampling using a rectangular train of pulses which permits the faithful reconstruction of the original signal. This might lead us to question whether the train of pulses needs to be rectangular. Will, say a train of triangular pulses have the same effect as the periodic rectangular train of pulses?

The answer is YES. **Figure 5.17**

Let us look more closely into our analysis of sampling using a rectangular train of pulses. This signal had a Fourier series representation and multiplication of the band-limited signal with it gave rise to a signal $\mathbf{x_s(t)}$. The spectrum of this signal had periodic repetitions of the original spectrum modulated by the Fourier series coefficients of the train of pulses. But this much would hold even if the rectangular pulse train were replaced by any periodic signal (whose Fourier series exists) with the same period.

The Fourier series coefficients would definitely change but we are interested only in the central copy. As long as that is non-zero we can still reconstruct the signal by passing it through an ideal low-pass filter. The constant Fourier series co-efficient is proportional to the average value of the periodic signal. Thus, any periodic signal, whose Fourier series exists, and has a non-zero average, with fundamental frequency greater than twice the bandwidth of the band-limited signal can be used to sample it; and the original signal can be reconstructed using an ideal low-pass filter.

Of course, if the periodic signal used has a zero average, like the one shown below, an ideal low-pass filter cannot be used for reconstruction.

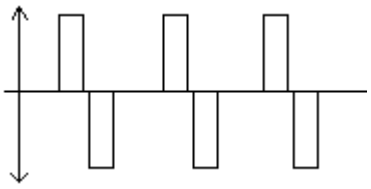

Figure 5.18