

EE3700 – Communications I

Tutorial 2

1. Figure 1 shows the waveform for a copper-modulated sine wave. This modulated wave is applied to a demodulator consisting of a mixer and an ideal low-pass filter with a pass band amplitude response of 1 and a bandwidth of B Hz. The LO input of the mixer is supplied with a locally generated carrier signal $10 \cos(2\pi f t + \phi)$ volts.
 - a) Find the spectrum at the output of the mixer assuming $\phi=0$.
 - b) If $f = 100\text{kHz}$, $\phi=0$ and modulation frequency f_m is in the range from 10Hz to 1kHz, specify the permissible range of the filter bandwidth B to allow only the modulating signal at the filter output.

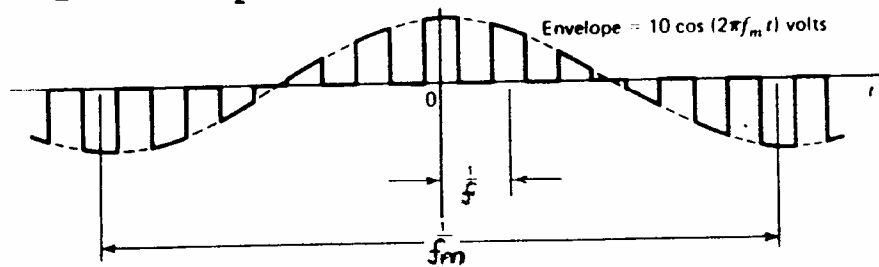


Figure 1

2. A Double SideBand (DSB) signal is demodulated by applying it to a synchronous detector. Evaluate the effect of a frequency error Δf in the local carrier frequency of the receiver, measured with respect to the actual carrier frequency of the DSB signal. For the case of a tone modulated wave, show that because of the frequency error, the demodulated wave will exhibit “beats” at the error frequency. Use a sketch to demonstrate the effect.
3. One circuit that can be used to synchronously demodulate a DSB signal is the Costa receiver. The block diagram of this circuit is shown in Figure 2. Describe how this circuit works.

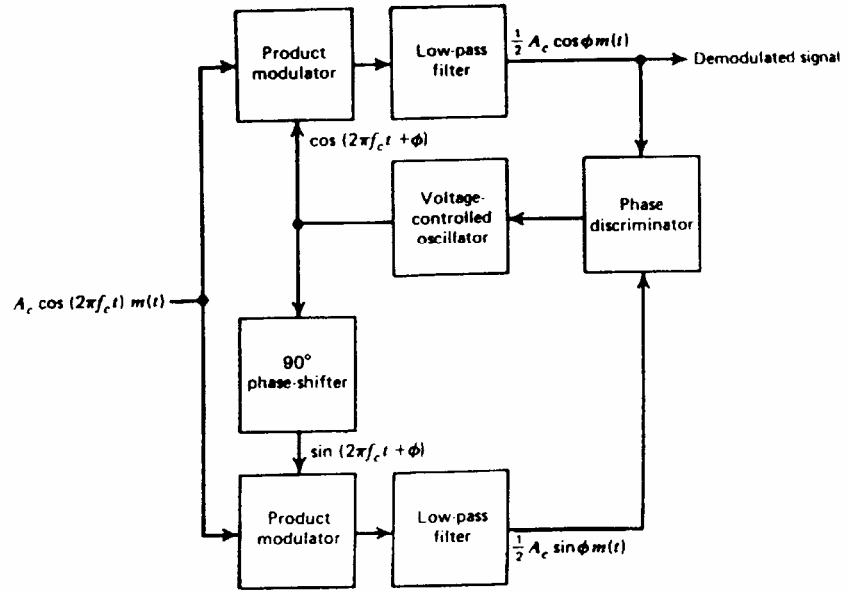


Figure 2