EE 4330

29 June 2010

Test 1

Modulated carrier \( m(t) \) at \( w_c \)

DSB-SC

\( P_5 \)

\[ M(t) \]

\[ f \]

\[ w \rightarrow B \]

\( B_W \) + \( B_H \)

Sketch:

\[ F \{ m(t) \cos(wt) \} \]

Magitude spectrum only

Identify LSB & USB

What is the BW?

Sketch magnitude spectrum of LPF

Coherent or synchronous demodulation

\[ \frac{1}{2} m(t) \]

LPF
2) Switching modulator (p. 8)

Sketch magnitude spectrum of BPF that yields the AM signal \( m(t) \cos \omega t \) (give FT of square wave)

3) Double bridge modulator (p. 7)

(show only series bridge)

\[ A \cos \omega t \]

During + half cycles diode \( D_1, D_2, D_3, D_4 \) – ?

\[ m(t) \cos \omega t \]

Sketch magnitude spectrum of BPF to yield
Ring modulator (P. 10)

During half cycle \( D_1 D_3 = \frac{2}{\pi} \), \( D_2 D_4 = \frac{2}{\pi} \).

Sketch magnitude spectrum of \( \text{BPF} \) and its output.

Mixer (P. 11)

\[ m(t) \cong \cos \omega_c t \]

\[ X(t) \]

\[ \frac{2 \cos (\omega_c + \omega_I) t}{2 \cos (\omega_c + \omega_I) t} \]

Sketch magnitude spectrum of \( X(t) \).

\[ \text{Output} \]

\[ m(t) \cos \omega_I t \]
6. AM (P. 12)

For envelope detection why $A \geq m_p$ is required, where $m_p$ is max magnitude of $m(t)$ & carrier is $A \cos(\omega t)$

7. AM $[A + m(t)] \cos(\omega t)$

DSB with carrier (P. 16)

\[
\text{Power efficiency} = \frac{1}{2}
\]

8. Generation of AM signals (P. 17)

Carrier $C \cos(\omega t)$

message $m(t)$ \[ C \Rightarrow m(t) \]

why?

Carrier during + halfcycle & Diode?

\[
\text{Sketch magnitude spectrum of BPF to get AM}
\]
9. Demodulation of AM signal (p. 18)

Sketch waveforms at each stage.

10. Envelope detection (p. 19)

Let \[ \frac{1}{\omega_c} \leq R_C < \frac{1}{2\pi B} \]

B is BW of \( w(t) \) in Hz. \( f_c \) is the carrier frequency.

Describe in detail how the envelope is detected.

11. (SSB) (p. 24)

Given DSB-SC, show how to get the USB (sketch the filters) & its magnitude spectrum.

Repeat a) for LSB.
12. What is the advantage of SSB signals?

13. Hilbert transform

$$m(t) \rightarrow HT \rightarrow m_h(t)$$

$$M(w) \rightarrow j\text{sign}(w) \rightarrow M_h(w)$$

$$M(w) \rightarrow -\pi \rightarrow M_+(w)$$

$$\cos w(t) \rightarrow HT \rightarrow ?$$

$$\sin w(t) \rightarrow HT \rightarrow ?$$

14. Generation of SSB signals (phase shift method)
15. \[ VSB \quad (P. 25) \]

- Define
- Advantages
- Dispersed

16. Compare advantages and disadvantages of DSB, SSB (USB/LSB) & VSB (suppressed carrier) with corresponding modulated signals with carrier.