CORRECTION TO LECTURE-20 (EEL-308)

BY: SAIF K. MOHAMMED

Previously it has been incorrectly stated that

$$\frac{1}{j\pi t} + \frac{\delta(t)}{2} \rightleftharpoons u(f)$$

where $u(f) = \begin{cases} 1, & f>0 \\ \frac{1}{2}, & f=0 \\ 0, & f<0 \end{cases}$

The correct statement is

$$\frac{-1}{j\pi t} + \frac{\delta(t)}{2} \rightleftharpoons u(f)$$

note the minus sign, which was missing in the previous lecture notes.

Similarly for the Hilbert Transformer $h_p(t) = \frac{1}{\pi t}$, the Fourier transform $H_p(f) = \int h_p(t) e^{-j2\pi ft} dt$ was incorrectly stated to be

$$H_p(f) = \begin{cases} j, & f>0 \\ 0, & f=0 \\ -j, & f<0 \end{cases}$$

Instead the correct $H_p(f)$ expression is

$$H_p(f) = \begin{cases} -j, & f>0 \\ 0, & f=0 \\ +j, & f<0 \end{cases}$$

You must accordingly change/ correct the derivation of the SCB transmission scheme, i.e., now the transmitted signal will be given by

$$s(t) = Re\{\tilde{s}(t) e^{j2\pi f_c t}\}$$

where $\tilde{s}(t)$ ↓ complex baseband

$$\tilde{s}(t) = m(t) \circledast h(t)$$

↑ convolution

where

$$H(f) = \begin{cases} 1, & f > 0 \\ \frac{1}{2}, & f = 0 \\ 0, & f < 0 \end{cases}$$

to as to communicate only the upper side band.

$$\text{since } h(t) = \frac{\delta(t)}{2} - \frac{1}{j2\pi t}$$

$$\tilde{s}(t) = \frac{m(t)}{2} + j\left[m(t) \circledast \left(\frac{1}{\pi t}\right)\right]$$

let $\hat{m}(t) \triangleq m(t) \circledast \frac{1}{\pi t} = \int \frac{m(\tau)}{\pi(t-\tau)} d\tau$

be the Hilbert Transform of $m(t)$.

then $\tilde{s}(t) = \frac{1}{2}[m(t) + j\hat{m}(t)]$

$\therefore$ $s(t) = \frac{1}{2}[m(t)\cos 2\pi f_c t - \hat{m}(t)\sin 2\pi f_c t]$