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EEEN 322 Spring 2019
QUIZ #1
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(Section 02)

Suppose you perform DSC-SC modulation and the modulated signal is $\varphi_{DSC-SC}(t) = e^{-2t}\cos(2\times 10^{8}\pi t)u(t)$.

a) Give the mathematical expression of the message signal $m(t)$. (20p)

b) Give the value of the carrier frequency in Hz. (10p)

c) Sketch $\varphi_{DSC-SC}(t)$. (20p)

d) Can we use an envelope or rectifier detector circuit for demodulation here (for the specific message signal of this question)? Why? Give a brief and neat explanation. (20p)

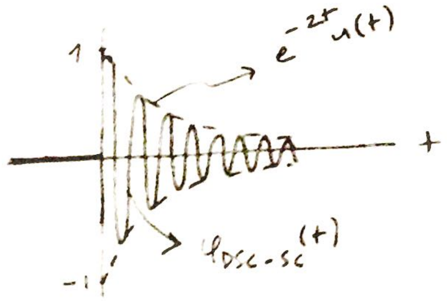
e) Write the mathematical expression of the spectrum $\Phi_{DSB-SC}(\omega)$. (30p)

(You may find the attached reference sheets useful)

a) $m(t) = e^{-2t}u(t)$

b) $\omega_c = 2\times 10^{8}\pi = 2\pi f_c \Rightarrow f_c = 10^{8}$ Hz $= 100$ MHz

c)



d) Yes we can, because $m(t) \geq 0 \;\forall t$, hence, the envelope of $\varphi_{DSC-SC}(t)$ is $m(t)$ itself.

e) $\varphi_{DSB-SC}(t) = m(t)\cos\omega_c t$

$\Rightarrow \Phi_{DSB-SC}(\omega) = \frac{1}{2}[M(\omega-\omega_c) + M(\omega+\omega_c)]$

Note that $m(t) = e^{-2t}u(t) \xleftrightarrow{\mathcal{F}} M(\omega) = \frac{1}{2+j\omega}$

(see the attached table)

$\Rightarrow \Phi_{DSB-SC}(\omega) = \frac{1}{2}\left[\frac{1}{2+j(\omega-2\times10^{8}\pi)} + \frac{1}{2+j(\omega+2\times10^{8}\pi)}\right]$

$= \frac{2+j\omega}{(2+j\omega)^2 + 4\times10^{16}\pi^2}$