BIRZEIT UNIVERSITY
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COMMUNICATION HW#1

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Q:1 For the signal $g(t)=Ae^{-\alpha t}u(t)$ where A=10 $\alpha=2$

a. find the Fourier transform G(f).

b. find the 3-dB bandwidth.

c. Find the equivalent rectangular bandwidth.

a. $G(f) = A\int_0^\infty e^{-at} e^{-j2\Pi ft}\,dt$

$= A\int_0^\infty e^{[-t(a+j2\Pi f)]}dt$

$= A \frac{1}{[a+j2\Pi f]}$

b. to find the bandwidth

$1/\sqrt{2}= A/[a+j2\Pi f]$

$A\sqrt{2}=a+j2\Pi f$

$F= 10\sqrt{2}-2/j2\Pi$

$Bw=10[2.8]/j2\Pi$

c. the rectangular $BW=\frac{\int G(f)\,df}{2G(0)}$

$= 2 \ln A \frac{1}{j2\Pi\,[a+j2\Pi f]}$

$= \infty$

Q:2 find the Hilbert transform for the signal g(t)=sin(t)/t
g(t) can be written as a sink function
=Π sinc (t/Π)
We find G(f)= Π(t/Π)
Π

Ĝ= -sgn Π(t/Π)
Π
$\hat{g} = {}_0\int_{-\Pi/2} -\Pi\ e_{-j2\Pi tot}\ dt + \int_0$
$_{\Pi/2}\ \Pi\ e_{-j2\Pi tot}\ dt$
$= \Pi\ e_{j\Pi 2to} + -\Pi\ e_{-j\Pi 2t}$
J2Πt j2Πt
$= -\ e_{j\Pi 2t} + e_{-j\Pi 2t}$
2jt
= sin(Π2t)/t= 1-cos/t.

Q3:
$X(t)=\{$ $A\cos(2\Pi f_c t)$ $0<t<T$
$\{$ 0 o.w
Is applied to linear filter with impulse response $h(t)=X(T-t)$
Where $T=nT_c$ n: integer $T_c=1/f_c$
Find and sketch the output y(t)?
$X(f) = A\ (\ \delta(f-f_c))$
$H(f)= A\ e_T\ \delta(f+f_c)+\ \delta(f-f_c)$
$= A\ e_T\ \delta(f)$
$Y(f)= X(f).\ Y(f)$
$= A_2 e_T \delta(f)$
$Y_+(f)= 2\ Y(f)$
$= 2Ae_T\delta(f)$
$\{y(t)= re\{\tilde{y}(t)\ e_{(j2\Pi f c t)}\}$