# Solution of ECE 316 Test #4 S04

1. A system impulse response, $h(t)$, has a unilateral Laplace transform, $H(s)=\dfrac{s(s-4)}{(s+3)(s-2)}$.

(a) (1 pt) What is the region of convergence (ROC) for $H(s)$? ROC is $\mathrm{Re}(s)=\sigma>2$

(b) (2 pts) Could the CTFT of $h(t)$ be found directly from $H(s)$? No

If not, why not? The region of convergence does not contain the ω axis.

OR

1. A system impulse response, $h(t)$, has a unilateral Laplace transform, $H(s)=\dfrac{s(s-4)}{(s+3)(s+2)}$.

(a) (1 pt) What is the region of convergence (ROC) for $H(s)$? ROC is $\mathrm{Re}(s)=\sigma>-2$

(b) (2 pts) Could the CTFT of $h(t)$ be found directly from $H(s)$? Yes

If so, what is it? $H(j\omega)=\dfrac{j\omega(j\omega-4)}{(j\omega+3)(j\omega+2)}$

2. The function, $H(s)=\dfrac{s-1}{(s+3)(s+2)(s+8)}$ can be written as $H(s)=\dfrac{K_1}{s+3}+\dfrac{K_2}{s+2}+\dfrac{K_3}{s+8}$. Find the numerical values of $K_1$, $K_2$ and $K_3$. $K_1$ = 0.8 , $K_2$ = -0.5 , $K_3$ = -0.3

Partial Fraction Expansion:

$$H(s)=\frac{s-1}{(s+3)(s+2)(s+8)}=\frac{\dfrac{-3-1}{(-3+2)(-3+8)}}{s+3}+\frac{\dfrac{-2-1}{(-2+3)(-2+8)}}{s+2}+\frac{\dfrac{-8-1}{(-8+3)(-8+2)}}{s+8}$$

$$H(s)=\frac{\dfrac{-4}{(-1)(5)}}{s+3}+\frac{\dfrac{-3}{(1)(6)}}{s+2}+\frac{\dfrac{-9}{(-5)(-6)}}{s+8}=\frac{0.8}{s+3}+\frac{-0.5}{s+2}+\frac{-0.3}{s+8}$$

3. (13 pts) The function, $H(s)=\dfrac{s(s-1)}{(s+3)(s+2)}$ can be written as $H(s)=K_1+\dfrac{K_2}{s+3}+\dfrac{K_3}{s+2}$. Find the numerical values of $K_1$, $K_2$ and $K_3$.

$K_1$ = 1 , $K_2$ = -12 , $K_3$ = 6

H is improper in *s*. First synthetically divide, then do partial fraction expansion.

$$H(s)=\frac{s^2-s}{s^2+5s+6} \quad , \quad \begin{array}{r|l} s^2+5s+6 & s^2-s \\ & \underline{s^2+5s+6} \\ & -6s-6 \end{array} \quad , \quad \therefore\ H(s)=1-\frac{6(s+1)}{(s+3)(s+2)}$$

$$H(s)=1-\left[\frac{\frac{6(-3+1)}{-3+2}}{s+3}+\frac{\frac{6(-2+1)}{-2+3}}{s+2}\right]=1-\left[\frac{12}{s+3}+\frac{-6}{s+2}\right]=1+\frac{-12}{s+3}+\frac{6}{s+2}$$