

6.003: Signals and Systems — Spring 2004

TUTORIAL 10 SOLUTIONS

Tuesday, April 27, 2004

Problem 10.1

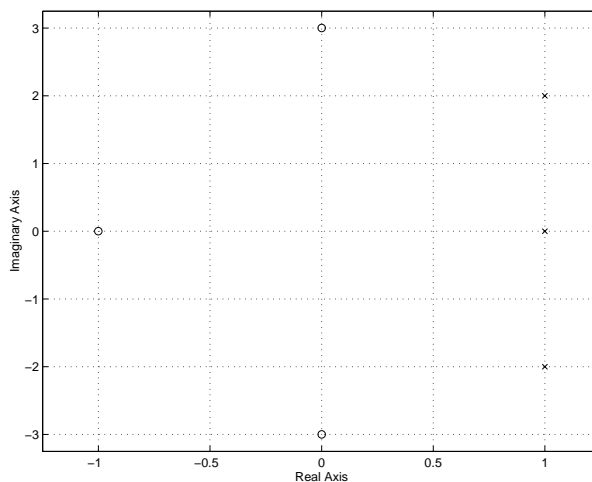


Figure 1: Pole zero plot

Problem 10.2

$$X(s) = \frac{1}{s+3} \quad \text{ROC: } \text{Re}\{s\} > -3$$

Problem 10.3

(a)

$$x_a(t) = -\frac{1}{t}e^{-t}u(t)$$

(b) (i)

$$x_b(t) = -5e^{-3t}u(-t) + 3e^{-2t}u(-t)$$

(ii)

$$x_b(t) = 5e^{-3t}u(t) + 3e^{-2t}u(-t)$$

(iii)

$$x_b(t) = 5e^{-3t}u(t) - 3e^{-2t}u(t)$$

Problem 10.4

1.

$$H(s) = \frac{1}{s^2 + \frac{5}{2}s - \frac{3}{2}}$$

2.

$$H(s) = \frac{-\frac{2}{7}}{s+3} + \frac{\frac{2}{7}}{s-\frac{1}{2}}$$

3. Poles are at -3 and $\frac{1}{2}$.

4. If system is causal,

$$\text{ROC : } \text{Re}\{s\} > \frac{1}{2}$$

If system is stable,

$$\text{ROC : } -3 < \text{Re}\{s\} < \frac{1}{2}$$

5. For causal system:

$$h(t) = -\frac{2}{7}e^{-3t}u(t) + \frac{2}{7}e^{\frac{1}{2}t}u(t)$$

For stable system:

$$h(t) = -\frac{2}{7}e^{-3t}u(t) - \frac{2}{7}e^{\frac{1}{2}t}u(-t)$$

Problem 10.5

Diagram	Step Response	Bode Plot
1	D	IV
2	F	V
3	H	II
4	A	VIII
5	E	VI
6	G	VII
7	C	III
8	B	I