2018 Systems and Signals HW9

Hw9: 9.21 (a,h), 9.22 (a,d), 9.23, 9.26 (due 6/14 after class)

9.21. Determine the Laplace transform and the associated region of convergence and pole-zero plot for each of the following functions of time:

(a) $x(t) = e^{-2t}u(t) + e^{-3t}u(t)$

(h) $x(t) = \begin{cases} t, & 0 \le t \le 1 \\ 2 - t, & 1 \le t \le 2 \end{cases}$

9.22. Determine the function of time, $x(t)$, for each of the following Laplace transforms and their associated regions of convergence:

(a) $\frac{1}{s^2+9}$, $\quad \mathcal{R}e\{s\} > 0$

(d) $\frac{s+2}{s^2+7s+12}$, $\quad -4 < \mathcal{R}e\{s\} < -3$

9.23. For each of the following statements about $x(t)$, and for each of the four pole-zero plots in Figure P9.23, determine the corresponding constraint on the ROC:

1. $x(t)e^{-3t}$ is absolutely integrable.
2. $x(t) * (e^{-t}u(t))$ is absolutely integrable.
3. $x(t) = 0,\ t > 1$.
4. $x(t) = 0,\ t < -1$.

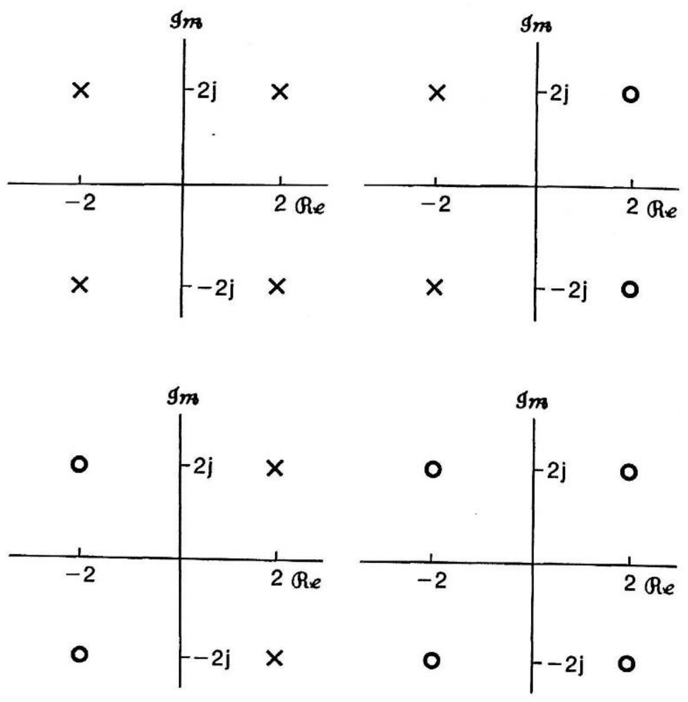

Figure P9.23

9.26. Consider a signal $y(t)$ which is related to two signals $x_1(t)$ and $x_2(t)$ by

$$y(t) = x_1(t-2) * x_2(-t+3)$$

where

$$x_1(t) = e^{-2t}u(t) \quad \text{and} \quad x_2(t) = e^{-3t}u(t).$$

Given that

$$e^{-at}u(t) \stackrel{\mathcal{L}}{\longleftrightarrow} \frac{1}{s+a}, \quad \Re e\{s\} > -a,$$

use properties of the Laplace transform to determine the Laplace transform $Y(s)$ of $y(t)$.