CLASSWORK 09: FALL 2024
CPE381

Instructor: Rahul Bhadani, The University of Alabama in Huntsville

September 23, 2024

Total: 15 points

1 Tell me about Systems.

The steady-state solution of stable systems is due to simple poles in the $j\omega$ axis of the s-plane coming from the input. Suppose the transfer function of the system is

$$H(s) = \frac{Y(s)}{X(s)} = \frac{1}{(s+1)^2 + 4} \tag{1}$$

1. Find the poles and zeros of $H(s)$ and plot them on the s-plane. **(2 points)**

2. Find then the corresponding impulse response $h(t)$. **(2 points)**

3. Determine if the impulse response of this system is absolutely integrable so that the system is BIBO stable. **(2 points)**

4. Let the input $x(t) = u(t)$, the unit-step function, and the initial conditions be zero, find $y(t)$ and from it determine the steady state solution. **(4 points)**

5. Let the input $x(t) = tu(t)$ and the initial conditions be zero, find $y(t)$ and from it determine the steady-state response. What is the difference between this case and the previous one? **(2 points)**

6. To explain the behavior in the case above consider the following: Is the input $x(t) = tu(t)$ bounded? that is, is there some finite value M such that $|x(t)| < M$ for all times? So what would you expect the output to be knowing that the system is stable? **(3 points)**