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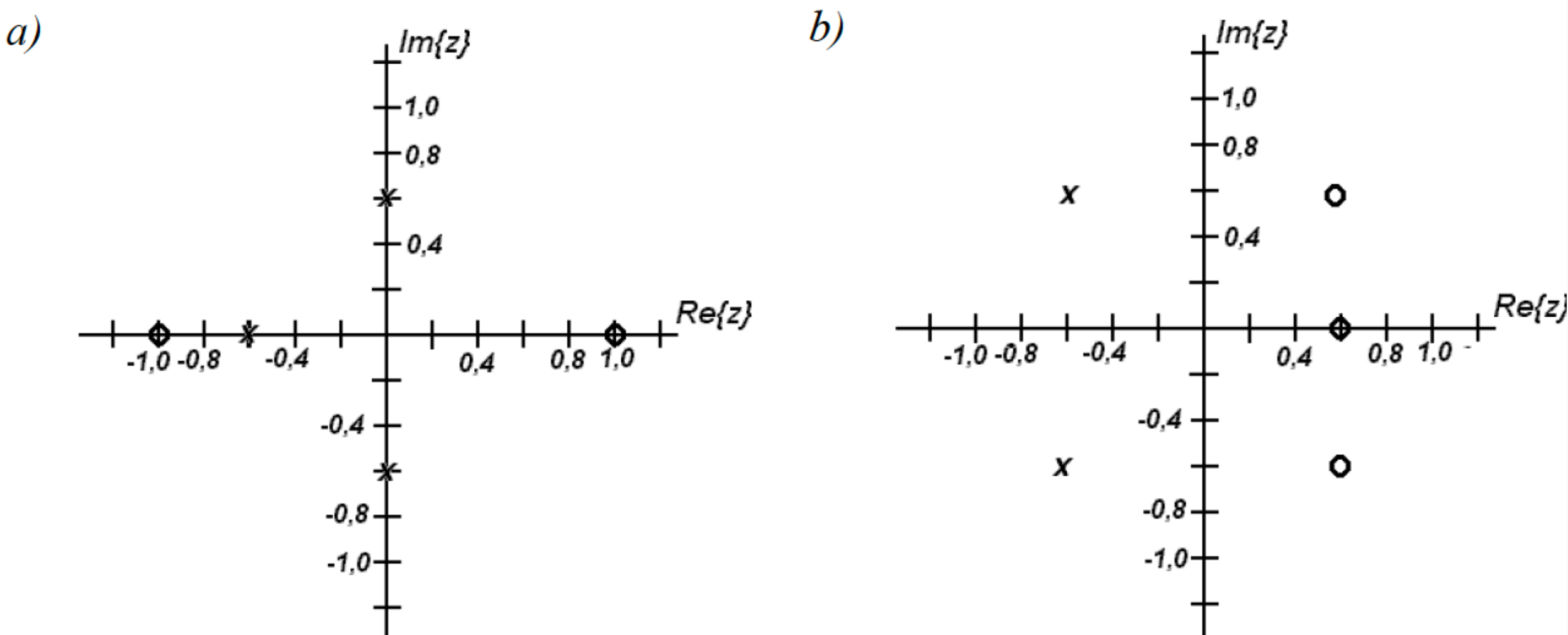
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Question 12 – Knowing the position of poles and zeros of the linear shift-invariant systems, determine $h[n]$ causal.



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answered by

Electrical engineering expert

1st step All steps Answer only

Step 1

The provided image illustrates the positions of poles and zeros for linear shift-invariant systems. To determine the causal impulse response, $h[n]$, based on the poles and zeros of the system, follow these steps:

Explanation:

1. Identify the positions of the poles (indicated by the "x" symbols) and the zeros (indicated by the "o" symbols).
2. Use the positions to derive the system's transfer function, $H(z)$.
3. Perform an inverse Z-transform on $H(z)$ to obtain $h[n]$.

Step 2

For the system in part a):

Zeros:

- ($z_1 = -0.8$) (Real axis)
- ($z_2 = -0.4 + 0.4j$) (Complex conjugate)
- ($z_3 = -0.4 - 0.4j$) (Complex conjugate)

Poles:

- ($p_1 = 0.8$) (Real axis)
- ($p_2 = 1.0$) (Real axis)

Using the identified poles and zeros, the transfer function is given by:

$$H(z) = k \frac{(z+0.8)(z+0.4-0.4j)(z+0.4+0.4j)}{(z-0.8)(z-1.0)}$$

To find $h[n]$, perform an inverse Z-transform on $H(z)$.

*

Step 3

*For the system in part b)**:

Zeros:

- ($z_1 = 0.8 + 0.4j$) (Complex conjugate)
- ($z_2 = 0.8 - 0.4j$) (Complex conjugate)

Poles:

- ($p_1 = -0.8$) (Real axis)
- ($p_2 = 1.0$) (Real axis)

Using the identified poles and zeros, the transfer function is given by:

$$H(z) = k \frac{(z-0.8-0.4j)(z-0.8+0.4j)}{(z+0.8)(z-1.0)}$$

Again, to find $h[n]$, perform an inverse Z-transform on $H(z)$.

Explanation:

Note: The constant k in both transfer functions represents a scaling factor. It can be determined by setting $z = 1$ in $H(z)$ if the system is stable and causal. In both cases, since all poles lie inside the unit circle, the systems are stable. If $h[n]$ is causal, then all poles must be outside the unit circle, which is not the case here

Answer

Answer and explanation are given above

Was this solution helpful?



1

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Q: $x(n) = 2\sin(\pi \cdot 0.038n) + \cos(\pi \cdot 0.38n)$ $n = 1500$ samples. Determine the position of poles and zeroes of the designed $H(z)$, and say whether or not the designed causal system is stable (explain this both theoretically and observing the poles positions).

Get the solution

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Q: [20 points] Consider a discrete-time causal system $h(n)$ whose zeros and poles are given as: (a) (5 points) Determine the z-transform $H(z)$ of the system for the above pole-zero diagram. [Hint: convert the poles in polar form first, and then use them to solve your problem.] (b) (10 points) Determine the inverse z-transform for $H(z)$ in Problem...

Get the solution

Q: Question 10 - For the linear shift-invariant system below, determine (1) the transfer function $H(z)$ and (2) the answer to $x[n] = (1/2)^n u[n]$.

Get the solution

Q: Question 15 - Determine the response $y[n]$ for the linear shift-invariant system described by its transfer function $H(Z)$ for the input $x[n] = u[n]$. $H(Z) = -1/(z^4 - 1)(8 - 4z^4 - 1 + z^4 - 2)$

Get the solution

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