Processamento Digital de Sinais

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Lista de exercícios 3 - Transformada Z

P4.3 Determine the z-transform of the following sequences using the z-transform table and the z-transform properties. Express $X(z)$ as a rational function in z^{-1}. Verify your results using MATLAB. Indicate the region of convergence in each case, and provide a pole-zero plot.

1. $x(n) = 2\delta(n-2) + 3u(n-3)$
2. $x(n) = 3(0.75)^n \cos(0.3\pi n)u(n) + 4(0.75)^n \sin(0.3\pi n)u(n)$
3. $x(n) = n\sin(\frac{\pi n}{3})u(n) + (0.9)^n u(n-2)$

P4.11 Determine the following inverse z-transforms using the partial fraction expansion method.

1. $X_1(z) = (1 - z^{-1} - 4z^{-2} + 4z^{-3})/(1 - \frac{11}{4}z^{-1} + \frac{13}{8}z^{-2} - \frac{1}{4}z^{-3})$. The sequence is rightsided.
2. $X_2(z) = (1 + z^{-1} - 4z^{-2} + 4z^{-3})/(1 - \frac{11}{4}z^{-1} + \frac{13}{8}z^{-2} - \frac{1}{4}z^{-3})$. The sequence is absolutely summable.
3. $X_3(z) = (z^3 - 3z^2 + 4z + 1)/(z^3 - 4z^2 + z - 0.16)$. The sequence is leftsided.
4. $X_4(z) = z/(z^3 + 2z^2 + 1.25z + 0.25)$, $|z| > 1$
5. $X_5(z) = z/(z^2 - 0.25)^2$, $|z| < 0.5$

P4.15 For the linear and time-invariant systems described by the following impulse responses, determine (i) the system function representation, (ii) the difference equation representation, (iii) the pole-zero plot, and (iv) the output $y(n)$ if the input is $x(n) = \left(\frac{1}{4}\right)^n u(n)$.

1. $h(n) = 5(1/4)^n u(n)$
2. $h(n) = n(1/3)^n u(n) + (-1/4)^n u(n)$
3. $h(n) = 3(0.9)^n \cos(\pi n/4 + \pi/3)u(n+1)$

P4.18 For the linear, causal, and time-invariant systems described by the following difference equations, determine (i) the impulse response representation, (ii) the system function representation, (iii) the pole-zero plot, and (iv) the output $y(n)$ if the input is $x(n) = 2(0.9)^n u(n)$.

1. $y(n) = [x(n) + 2x(n-1) + x(n-3)]/4$
2. $y(n) = x(n) + 0.5x(n-1) - 0.5y(n-1) + 0.25y(n-2)$
3. $y(n) = 2x(n) + 0.9y(n-1)$
4. $y(n) = -0.45x(n) - 0.4x(n-1) + x(n-2) + 0.4y(n-1) + 0.45y(n-2)$

Fonte: Ingle/Proakis, Digital Signal Processing Using Matlab - 3ª Edição.