UNIT - V: Z-Transforms

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Definition of Z-Transform

The Z-transform converts a discrete-time function into a complex frequency domain representation:
[Z[f(n)] = F(z) = \sum_{n=0}^{\infty} f(n)z^{-n}]

Elementary Properties of Z-Transforms

Key properties include:
• Linearity: (Z[a f(n) + b g(n)] = aZ[f(n)] + bZ[g(n)])
• Time Shifting: (Z[f(n-k)] = z^{-k} F(z))
• Scaling: (Z[a^n f(n)] = F(z/a))
• Differentiation: (Z[n f(n)] = -z \frac{dF(z)}{dz})

Inverse Z-Transform

The inverse Z-transform retrieves the original sequence from the Z-domain function. Methods include:
• Partial Fraction Expansion
• Residue Method
• Power Series Expansion
• Contour Integration

Solution of Difference Equations using Z-Transforms

Steps to solve a difference equation using Z-transforms:
1. Apply Z-transform to the equation.
2. Solve for F(z).
3. Apply inverse Z-transform to obtain f(n).