TOPIC 1: Introduction to Z transforms

Z – Transforms & Different Equ/:

UNIT – V

Re - requisite :.

1, $(1+x)^{-1} = 1 - x + x^2 - x^3 + \cdots\cdots$ if $|x| < 1$

2, $(1-x)^{-1} = 1 + x + x^2 + x^3 + \cdots\cdots$ if $|x| < 1$

3, $(1-x)^{-2} = 1 + 2x + 3x^2 + \cdots\cdots$

4, $(1+x)^{-2} = 1 - 2x + 3x^2 - 4x^3 + \cdots\cdots$

5, $e^{x} = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \cdots\cdots$

6, $\log(1-x)^{-1} = x + x^2/2 + x^3/3 + \cdots\cdots$

7, $\sum_{n=0}^{N} a^n = \frac{a^{N+1} - 1}{a - 1}$

8, $e^{i\theta} = \cos\theta + i\sin\theta$

   ||ly $e^{-i\theta} = \cos\theta - i\sin\theta$

9, $\cos^3\theta = \frac{1}{4}\left[3\cos\theta + \cos 3\theta\right]$

10, $\sin^3\theta = \frac{1}{4}\left[3\sin\theta - \sin 3\theta\right]$

UNIT Step function of Z-transform

$$u(k): \{1,1,1\ldots\} = \begin{cases} 1, & k \geq 0 \\ 0, & k < 0 \end{cases}$$

Unit Impulse function

A discrete unit impulse function is defined by,

$$\delta(k): \{1,0,0\ldots\} = \begin{cases} 1; & k = 0 \\ 0; & k \neq 0 \end{cases}$$

Partial fraction

1, $\dfrac{1}{(ax+b)(cx+d)} = \dfrac{A}{(ax+b)} + \dfrac{B}{(cx+d)}$

2, $\dfrac{1}{ax^2+bx+c} = \dfrac{Ax+B}{ax^2+bx+c}$

(not fractized)

3, $\dfrac{1}{(ax+b)^3} = \dfrac{A}{(ax+b)} + \dfrac{B}{(ax+b)^2} + \dfrac{C}{(a+b)^3}$

Z - transform (one sided or unilateral)

Let $\{f(n)\}$ be a sequence defined for $n = 0, 1, 2, \ldots$ and $f(n) = 0$ for $n < 0$, then its Z-transform is

$$\boxed{Z\{f(n)\} = F(z) = \sum_{n=0}^{\infty} f(n)\cdot z^{-n}}$$

where, z is an orbitary complex number.

Definition:

Z - transform for discrete values of (t)

If $\{f(t)\}$ is a function defined for discrete value of (t) where, $t = nT$

$$z\{f(t)\} = F(z) = \sum_{n=0}^{\infty} f(nT)\, z^{-n}$$

$n = 0, 1, 2, \ldots, T$ be in the sampling period, then Z-tranform of $f(t)$ is defined as,

$$\boxed{z\{f(t)\} = F(z) = \sum_{n=0}^{\infty} F(nT)\, z^{-n}}$$