classmate
Date
Page

Q.2) Compare the digtal and analog Filter.

Digtal Filter	Anlog Filter
1) operates on digtal samples (or sampled version) of the signal	1) operates on anlog signals (or actual signals)
2) It is defined by linear difference eqution	2) It is defined by linear differential equation.
3) It consists of adders, multipliers and delays implmented in digtal logic	3) It consists of electrical components like resistors, capacitors and inductors.
4) In digital filters the filter coeFFicents are designed to satisfy the desired Frequncy responce	4) In anlog Filters the approximation problem is solved to satisfy the desired Frequncy responce.
5) ~~Higher cost~~ ~~its depends~~ lower cost ~~on anlog~~	4) Higher cost its depend on the anlog componant.

Q.4)

⇒ i) The ~~impl~~ transfer function of anlog filter

$$H(s) = \frac{2}{(s+1)(s+2)}$$

ii) The sampling period $T = 1 sec$

iii) express $H(s)$ as the sum of single pole Filters

$$H(s) = \sum_{k=1}^{N} \frac{C_k}{s-p_k}$$

$$H(s) = \frac{2}{(s+1)(s+2)} = \frac{A}{s+1} + \frac{B}{s+2}$$

A :-

$$A \Rightarrow \frac{2}{(s+1)(s+2)} \times s+1 \Big|_{s=-1}$$

$$A \Rightarrow \frac{2}{-1+2} = 2 = A$$

$A = 2$

B :-

$$B = \frac{2}{(s+1)(s+2)} \times (s+2) \Big|_{s=-2}$$

$\cancel{H(s)}$

$$= \frac{2}{-2+1} = -2 = B$$

$B = -2$

18.647
1.2644

$$H(s) = \frac{2}{s-(-1)} - \frac{2}{s-(-2)}$$

iv) compute The z-transform of the digital filter

$$H(z) = \sum_{k=1}^{N} \frac{c_k}{1-e^{p_k T} z^{-1}} = \frac{c_1}{1-e^{p_1 T} z^{-1}} + \frac{c_2}{1-e^{p_2 T} z^{-1}}$$

$$\left.\begin{array}{l} p_1 = -1;\ p_2 = -2 \quad \text{and} \quad T = 1 \\ c_1 = +2;\ c_2 = -2. \end{array}\right\} \text{sub}$$

$$H(z) = \frac{2}{1-e^{-1} z^{-1}} - \frac{2}{1-e^{-2} z^{-2}}$$

$$H(z) = \frac{2}{1-0.3678 z^{-1}} - \frac{2}{1-0.135335 z^{-1}}$$

Taking Lcm

$$H(z) = \frac{2(1-0.1353 z^{-1}) - 2(1-0.3678 z^{-1})}{(1-0.3678 z^{-1})(1-0.135335 z^{-1})}$$

$$= \frac{2-0.2706 z^{-1} - 2 + 0.7356 z^{-1}}{1-0.1353 z^{-1} - 0.3678 z^{-1} + 0.04498 z^{-2}}$$

$$\boxed{H(z) = \frac{0.465 z^{-1}}{1-0.5031 z^{-1} + 0.0498 z^{-2}}}$$