Decimation using Sinc filters

1/16 1/8 1/4

.25V

01 +1 1V

11 -1 0V

01000

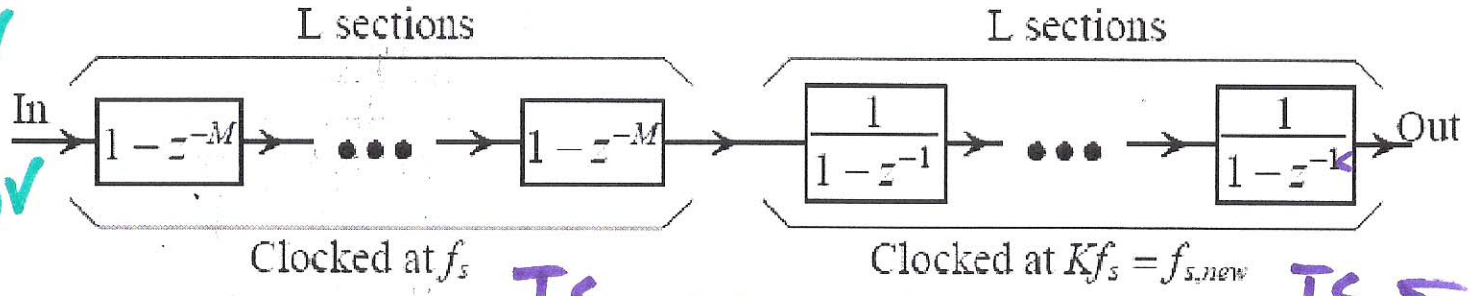


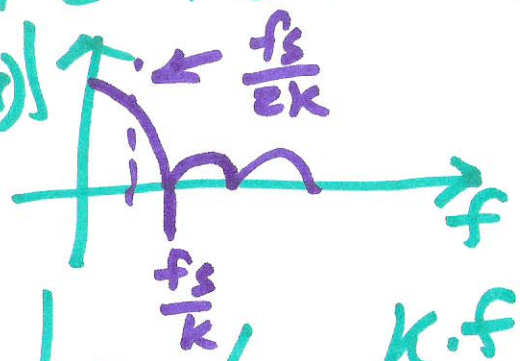
Figure 4.30 General ~~interpolation~~ decimation using Sinc filters.

Ts → KTs

$\frac{Ts}{K}$ ← Ts

$$H(z) = \frac{1-z^{-K}}{1-z^{-1}} = 1 + z^{-1} + z^{-2} + \cdots z^{-(K-1)}$$

Sinc filter for large K

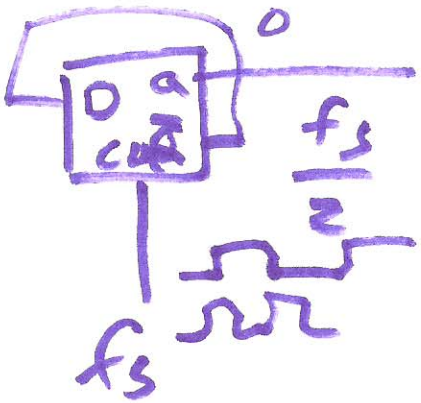


$$|H(f)| = K \cdot \left| \mathrm{Sinc}\left(\pi \frac{K \cdot f}{f_s}\right) \right|$$

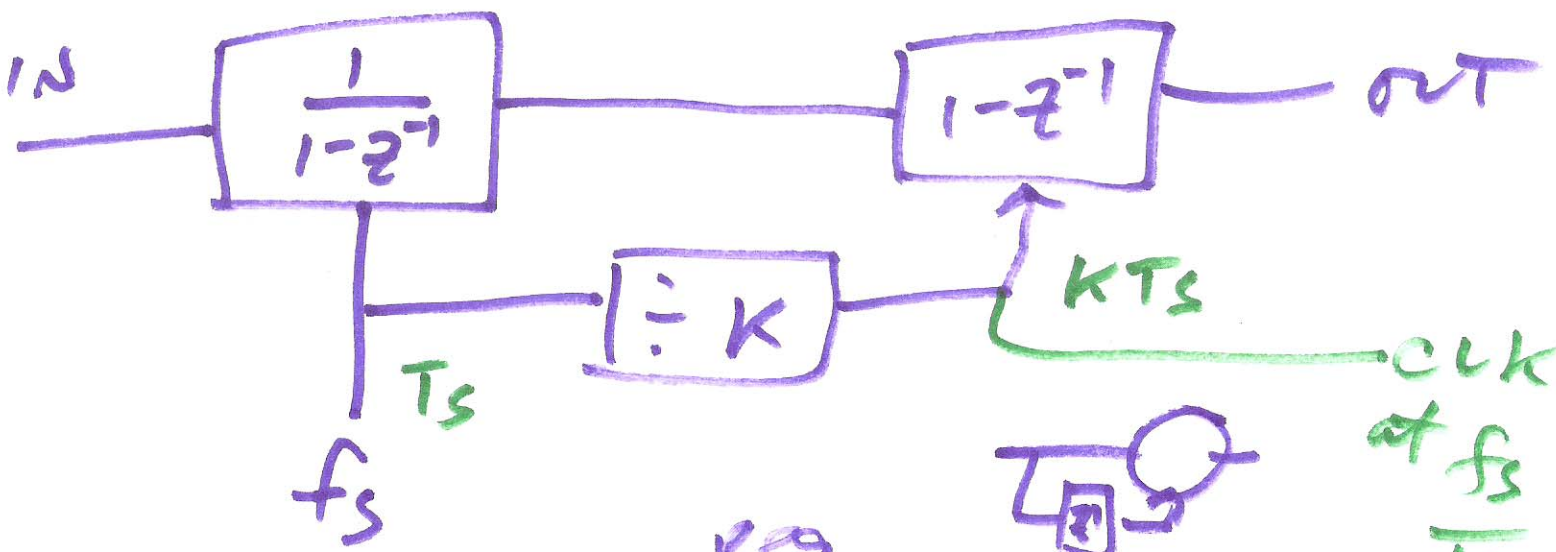
1)

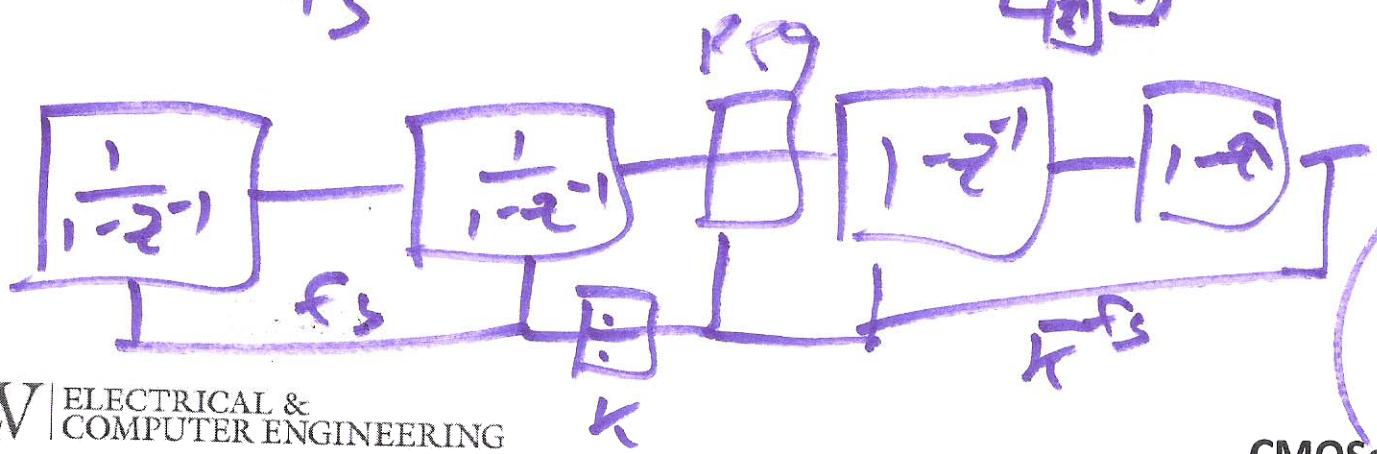
$$\frac{1-z^{-K}}{1-z^{-1}}$$

$f_s \rightarrow \frac{f_s}{2}$



Decimation $1-z^{-K}$





$\left(\frac{1-z^{-K}}{1-z^{-1}}\right)^2$

$$\left[\frac{1-z^{-k}}{1-z^{-1}}\right]^L = \left[1 + z^{-1} + z^{-2} + \cdots z^{-(k-1)}\right]^L$$

$$\left[(1+z^{-1})(1+z^{-2})(1+z^{-4})\cdots(1+z^{-2^{\log_2 k-1}})\right]^L$$

$$1 + z^{-1} + z^{-2} + z^{-3} + \cdots z^{-15} \qquad k = 16$$

$$2^{\log_2(k-1)} \qquad 2^{\log_2 k} - 1$$

$$(1+z^{-1})^L \cdot (1+z^{-2})^L \cdot (1+z^{-3})^L \cdots (1+z^{-15})^L$$

3)

$$\left[\frac{1-z^{-k}}{1-z^{-1}}\right]^L = \left[1+z^{-1}+z^{-2}+\cdots z^{-(k-1)}\right]^L$$

$16 \times 16 = 256$

$$= \left[(1+z^{-1})(1+z^{-2})(1+z^{-4})\cdots 1+z^{-2^{\log_2 k-1}}\right]^L$$

$+1-(-1)=2$

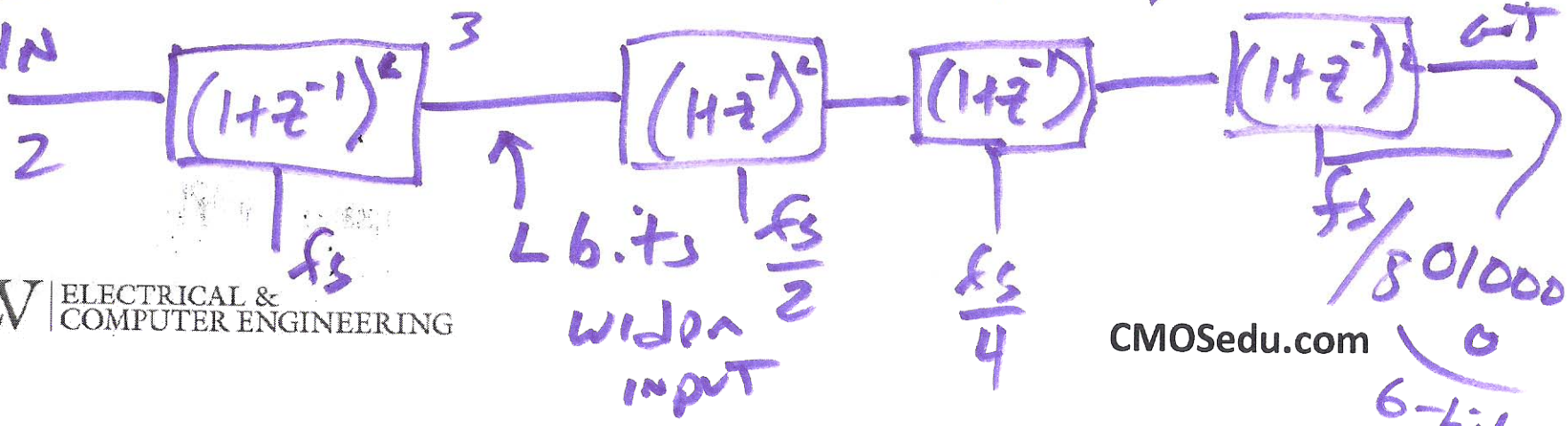
$-1-(+1)=-2$

$k=16$

$$= \left[(1+z^{-1})^L(1+z^{-2})^L(1+z^{-4})^L(1+z^{-8})^L\right)$$

$K=16, L=1$

01
11
→ 01



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