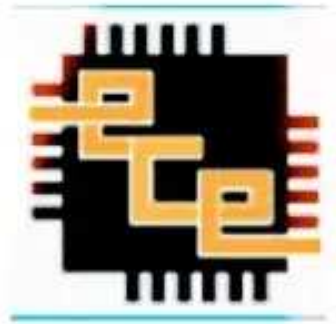
# Unit V: FIR Filters
## FIR Filter Realization

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# Overview



# Digital Filters

A Linear time-invariant discrete-time systems are characterised by the the general linear constant coefficient difference equation

$$y(n) = -\sum_{k=1}^{N-1} a_k y(n-k) + \sum_{k=0}^{M-1} b_k x(n-k)$$

By means of $z$-transform, linear time-invariant discrete-time systems are characterised by ration transfer function

$$H(z) = \frac{\sum_{k=0}^{M-1} b_k z^{-k}}{1 + \sum_{k=1}^{N-1} a_k z^{-k}}$$

# Digital Filters

Depending on the structure of $H(z)$, we have two types of digital filter:

1. FIR filters: All zero systems (also called as moving average system).

$$y(n) = \sum_{k=1}^{M} b_k x(n-k)$$

$$H(z) = 1 + \sum_{k=1}^{N} a_k z^{-k}$$

2. IIR filters: All pole systems (also called as autoregressive system).

$$y(n) = -\sum_{k=1}^{N} a_k y(n-k) + b_0 x(n)$$

$$H(z) = \frac{1}{1 + \sum_{k=1}^{N} a_k z^{-k}}$$

# Factors influence the choice of structure

The block diagram representation of a system is referred to as *realization*.

The factor that plays an role in deciding the structures:

1. Computational complexity
2. Memory requirements
3. Finite word length effects