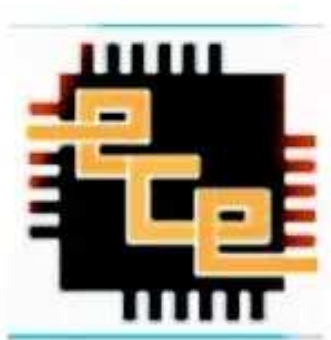


Unit V: FIR Filters

FIR Filter Realization



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Overview

1 Introduction

2 Structures for Realization of Discrete-Time Systems



Basic Building Blocks

3 Filter Structures

4 IIR Filter Structures

5 FIR Filter Structures

- Direct-form structure
- Cascade-form structure
- Lattice structure

6 Lattice structure (IIR)



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

