SNS COLLEGE OF ENGINEERING

An Autonomous Institution

Coimbatore-641 107

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19EC504-ANALOG AND DIGITAL COMMUNICATION

III YEAR/ V SEMESTER

UNIT - III - DIGITAL COMMUNICATION

TOPIC - EQUALIZATION – LINEAR EQUALIZATION

Equalization

- Equalization in digital communication refers to the process of compensating for signal distortions caused by the transmission medium, such as:- Attenuation (loss of signal strength)- Dispersion (spreading of signal in time)- Noise (interference)
- Equalization techniques aim to restore the original signal shape and amplitude, ensuring reliable data transmission.

Common equalization methods include:

1. Linear Equalization (LE)

2. Decision-Feedback Equalization (DFE)

3. Maximum Likelihood Sequence Estimation (MLSE)

4. Adaptive Equalization (AE) Equalization is crucial in digital communication systems, such as:- Wireless communication (e.g., Wi-Fi, 4G/5G)- Cable modems- Digital subscriber line (DSL)- Satellite communication

Benefits of equalization:-

- Improved signal-to-noise ratio (SNR)
- Increased data transmission rates
- Reduced errors and retransmissions
- Enhanced overall system performance and reliability

Linear Equalization

Linear Equalization (LE) is a technique used to compensate for signal distortions in digital communication systems.

It involves using a linear filter to reverse the effects of the channel and restore the original signal shape.

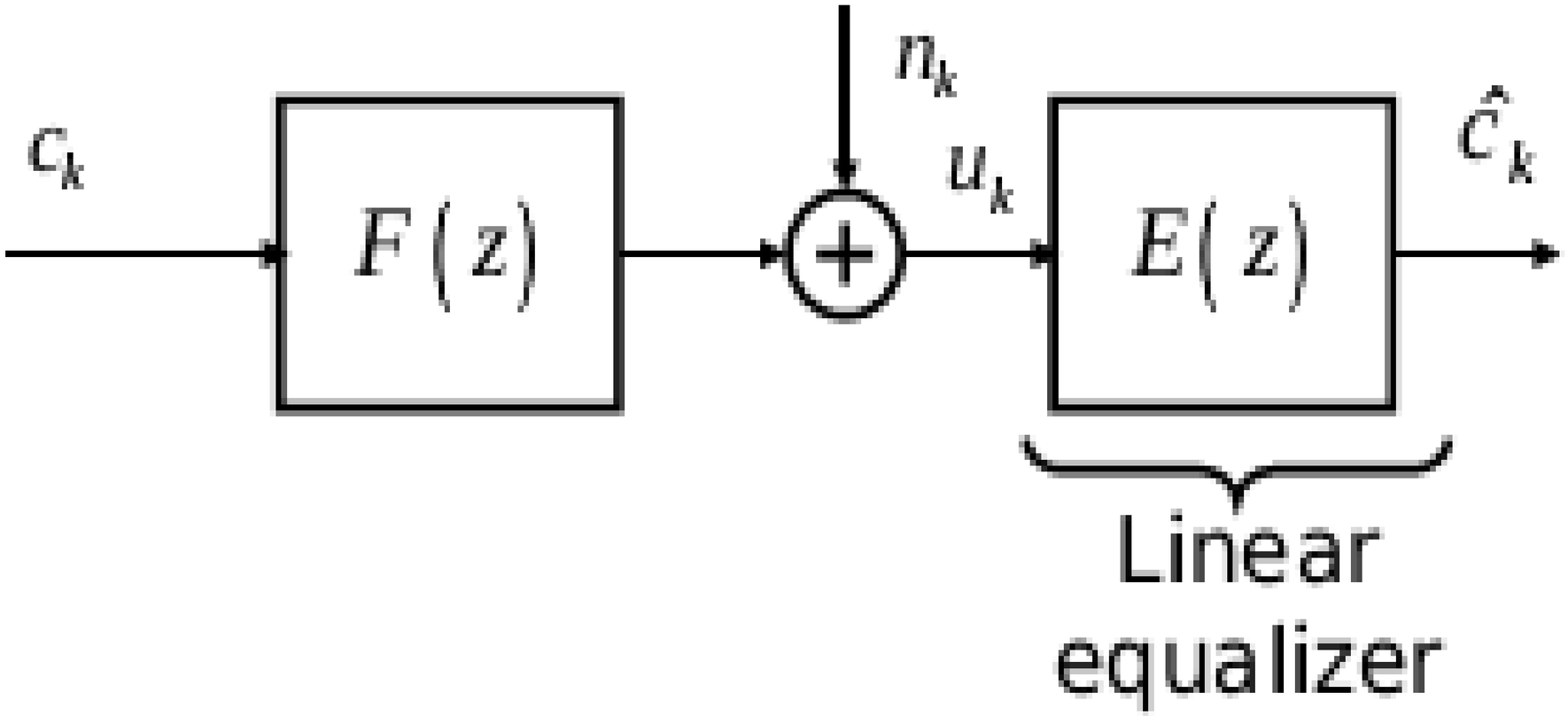
Key aspects of Linear Equalization:

1. Filter coefficients: Calculated based on the channel impulse response.
2. Filter structure: Typically a transversal filter or a lattice filter.
3. Adaptation: Filter coefficients are adjusted to optimize performance.

Types of Linear Equalization:

1. Zero-Forcing (ZF) Equalization: Forces the ISI (Inter-Symbol Interference) to zero.
2. Minimum Mean-Square Error (MMSE) Equalization: Minimizes the mean-square error between the equalized signal and the original signal.

Block Diagram – Linear Equalizer



Advantages and Disadvantages – Linear Equalization

Advantages of Linear Equalization:

1. Simple implementation

2. Low computational complexity

3. Effective for channels with mild ISI

Disadvantages of Linear Equalization:

1. May not perform well for channels with severe ISI

2. Can amplify noise Linear Equalization is widely used in various digital communication systems, including wireless communication, cable modems, and digital subscriber lines (DSL).

Applications of Linear Equalization

1. Wireless Communication
2. Cable Modems
3. Digital Subscriber Lines (DSL)
4. Satellite Communication

THANK YOU