BROADBAND BEAMFORMING

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INTRODUCTION

- Equalization
  - Channel distortion results in Inter-Symbol Interference (ISI) which has to be compensated for to reduce the probability of error
  - Such a compensator is called an *equalizer*
- Problem in Broadband Communications
  - High data rates are transmitted
  - The problem hence is to design equalizers of sufficiently low complexity without sacrificing too much on ISI mitigation

TYPES OF EQUALIZERS

- Maximum Likelihood Sequence Detection
  - *Optimal* in terms of *probability of error*
  - Disadvantage: Exponential increase in computation requirements with increase in channel memory
- Linear Equalizers
  - Used when computational complexity of MLSE is prohibitive
  - Sub-optimal approach to equalization

Broadband Beamformers

- MLSE is not implementable in the broadband case due to computational complexity
- ISI is hence reduced to narrowband levels before the equalizer
- Utilizes a space-time receiver made up of an antenna array followed by an FIR filter bank
- Output noise is colored and filter coefficients are chosen to satisfy the *power complememtarity* property to ensure white noise at receiver output [*Koca and Levy, 2002*]

Koca and Levy, 2002

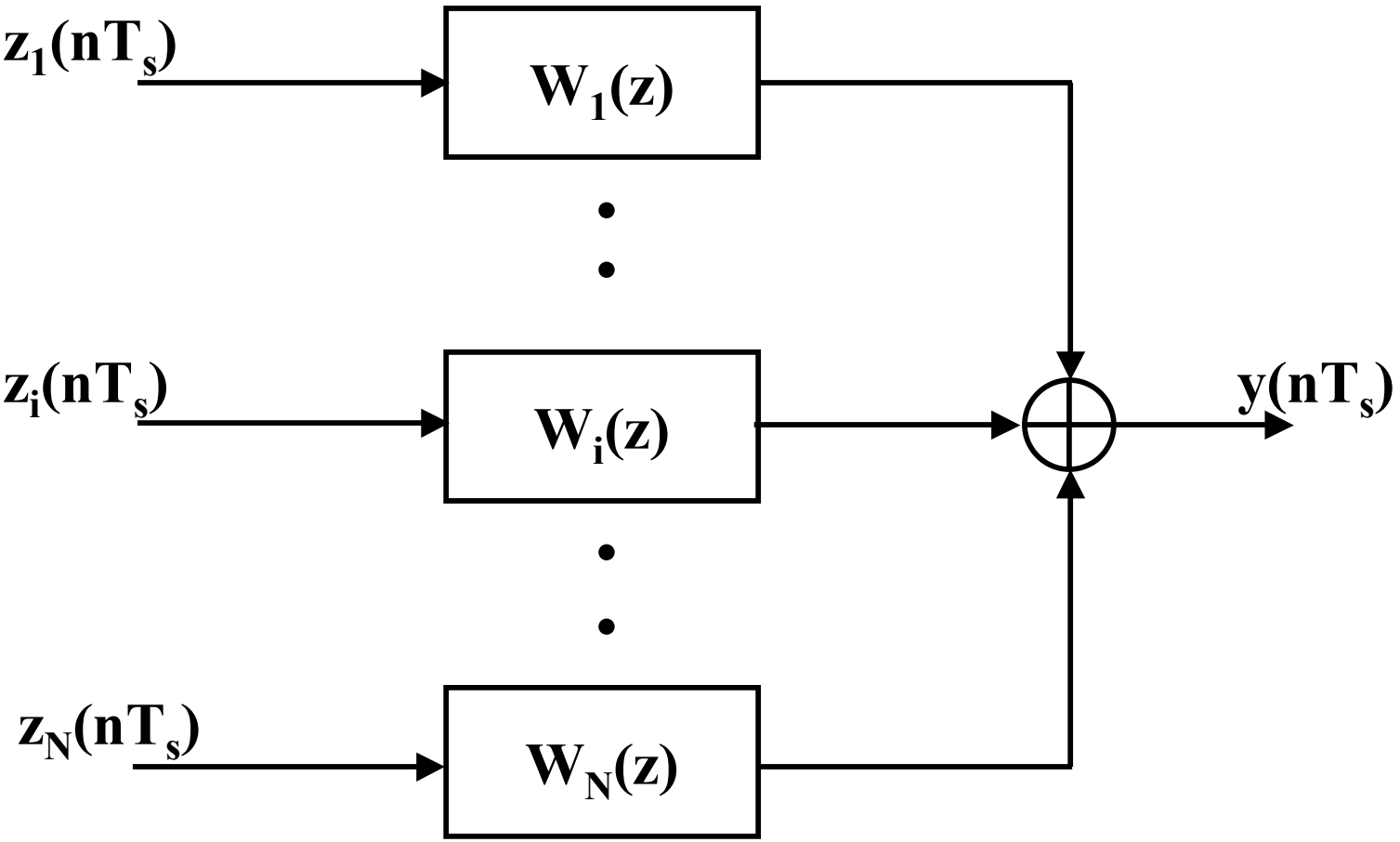
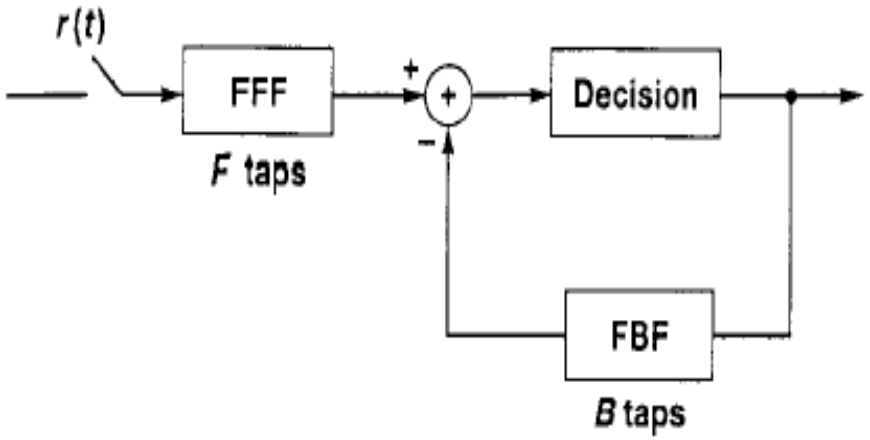


Fig. 1. Broadband Beamformer

DECISION FEEDBACK EQUALIZATION (DFE)

- Consists of a feedforward and feedback filter as shown
- Feedback filter removes that part of the ISI from the present estimate caused by previously detected symbols
- Technique to shorten the feed forward filter for low complexity implementation (*Ariyavisitakul and Greenstein, 1997*)



FREQUENCY DOMAIN EQUALIZERS

- Technique that exhibits relatively low complexity growth with increasing memory in channel
- This property is exploited to design equalizers for the broadband case (*Clark, 1998*)