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Extenuating Interference in Wireless Communication

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Abstract- In this paper we have studied two types of interferences in wireless communication that is Intersymbol interference and Co-channel intereference. The goal of this paper is to find their extenuating techniques. We have also presented BER vs CIR and FER vs CIR performances in JD IRC-DDFSE receivers.

Keywords- Intersymbol Interference, Co-channel Interference, Bit Error Rate, Carrier-to-Interference Ratio, Joint Detection Interference Rejection Combining, Delayed Decision Feedback Sequence Estimation, Frame Error Rate, Minimum Mean Square Error.

1. INTRODUCTION

During the last two decades, wireless communication has evolved from an optional convenience to an indispensable necessity in daily life. Advances in digital signal processing, digital computing, and radio transmission technologies have facilitated the introduction of a wide range of wireless communication services. Second generation wireless mobile communication systems such as GSM, IS-95, IS-136 and PDC provide people reliable narrowband communication links mostly for voice and text traffics with high mobility, and high-speed private- and public-access wireless local/personal area networks (WLAN/WPAN) such as Wi-Fi and Bluetooth deliver broadband multimedia traffic with limited mobility. However, increasing demands on high-capacity wireless multimedia services with sufficient mobility have created challenging tasks to the designers of next generation wireless mobile communication systems. Because of the randomness of the mobile propagation channels and limited radio spectrum, co-channel interference (CCI), fading and intersymbol interference (ISI) are major impediments to high-capacity transmission in power- and bandwidth-limited wireless communication systems.

2. INTERFERENCE MITIGATION TECHNIQUES

The characteristics of CCI and ISI of a wireless communication system is determined by the radio interface and the network topology of the system. Accordingly, a broad range of interference mitigation techniques have been employed at transmitter and/or receiver as illustrated in Figure 1 given below

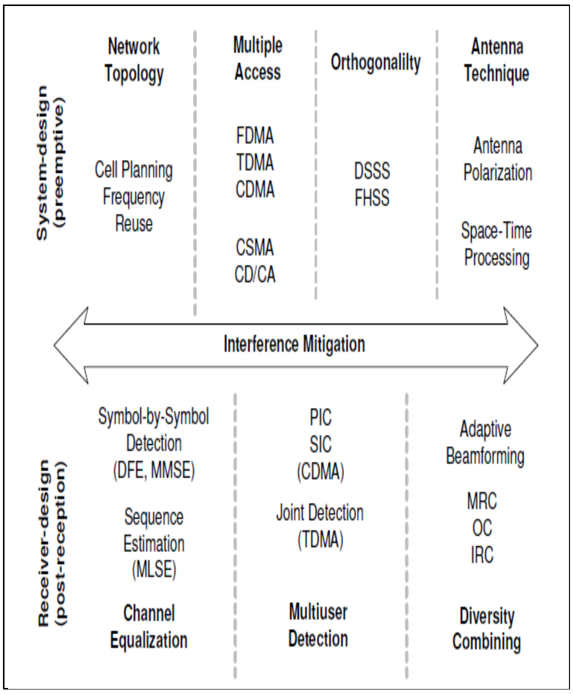

Figure 1

In system-design approaches, transmission of co-channel signals is properly managed so that the power of received CCI is maintained below an acceptable level [1,2,3]. In contrast, receiver-design approaches actively mitigate the CCI/ISI which cannot be separated by the preemptive system-design approaches. In practical systems, both approaches are employed in joint fashions to reduce the interference.

(2.1) Adaptive filtering

Interference cancelling receiver design is often viewed as an adaptive filtering with feed forward and feedback filters as illustrated in Figure 2 [4]. This technique ends its root in adaptive equalization research, which primarily focuses on mitigating ISI with single antenna by using linear and nonlinear techniques. However, previous works of Lo et al. [5],Petersen et al. [6], and Yoshino et al. [7] showed that equalization techniques effectively mitigate CCI as well ISI. Two types of equalizers using linear or nonlinear techniques can be found in many references: symbol-by-symbol equalizers and sequence estimators. The most common structure for the linear equalizer is the transversal filter in which the current and past values of the received signal are weighted by equalizer coefficients and summed to produce the output for symbol-by-symbol decisions on the received symbol sequence.

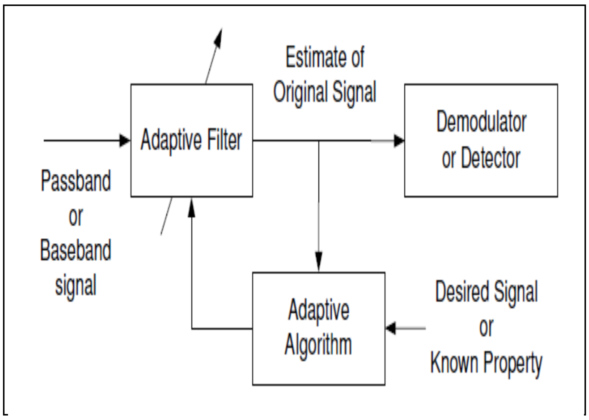

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Figure 2

The equalizer coefficients are adjusted to minimize some error criterion. The equalizer the forces ISI to zero is called zero-forcing (ZF) equalizer. The MMSE equalizer outperforms the ZF equalizer in performance and convergence properties by mitigating the noise enhancement [8,9].

Signal and Interference Model for Asynchronous SFH Bluetooth Networks .The Bluetooth system is designed to provide simple and robust short-range high-data-rate physical layer transmission as an alternative to existing various wires for data transmission between computer and communication peripherals, and is designed to operate in 2.4 GHz ISM band. The corresponding power spectral density is

$$S_N(f) = \begin{cases} \frac{N_0 f^2}{A_c^2}, & |f| \le \frac{B}{2} \\ 0, & \text{elsewhere} \end{cases}$$

3. RESULTS

The performance of the JD IRC-DDFSE receiver has been tested for BER, CIR and FER performances. Figure 3 compares the BER performance of the proposed receiver to a conventional single user detection receiver with an NBAA array configuration. A CIR gain of approximately 10 to 15 and 1 to 3 dB is achieved over the conventional receiver for GSM and EDGE systems, respectively, at a decoded BER of 10.2. Note that the joint detection structure achieves higher gain in a low CIR range than in a high CIR range.

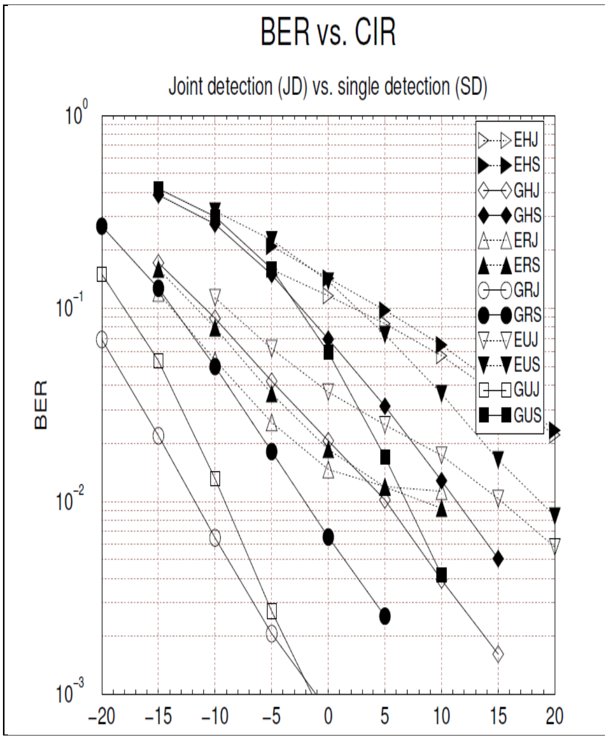

Figure 3

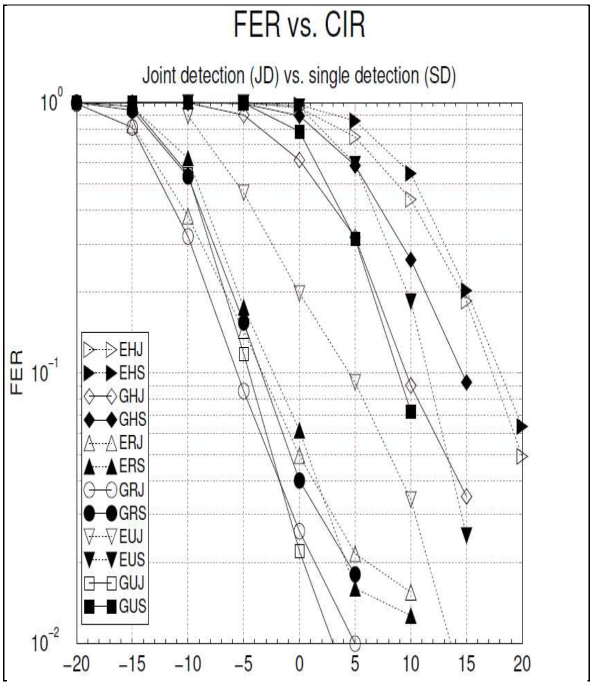

Figure 4

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