



Enhancing Signal Detection in Frequency Selective Channels by Exploiting Time Diversity in Inter-symbol Interference Signal

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Abstract

Inter-symbol interference (ISI) causes many errors in modulated symbols, when they are transmitted through band-limited channels. According to the multipath delay profile of the channel, the modulated symbol may disperse over more than one symbol period causing interferences among the received symbols. In this paper, the ISI signal is not considered as a problem, but it is exploited as a source of time diversity for the modulated symbols. The ISI signal is considered as if the modulated symbols are transmitted more than one time through different symbols periods. The number of periods over which the modulated symbol extends, represents the time diversity gain of the proposed system. In the proposed receiver, the interfering symbols are considered as symbols from different users. A multi-user detector is used to demodulate these interfering symbols. Moreover, a signal combiner is used to collect the detected symbol from the output of the multiuser detector through the dispersion period of the channel. The output of the combiner represents the decision variable to the baseband detector. The diversity gain in the decision variable in the proposed receiver is proportional to the dispersion period of the channel.

Keywords Inter-symbol interference · Time diversity · Multiuser detectors · Decorrelator detector · MMSE detector · Signal combining

1 Introduction

The developments in communication systems aim to increase the data transmission rates to meet the growing needs of the communication markets [1–3]. The researchers aim to increase the data rates without increasing the transmission bandwidth or the transmitted power in the developed systems [4–6]. In the past, three factors are used to measure the attributes of the communication systems. These factors are the power efficiency, the bandwidth efficiency and the complexity or the cost of the systems. A fourth factor is added in the modern communication systems. This factor is the amount of the interferences in

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