

Spring 2022 – Cooperative Communications and Networks

Tips on Reading Papers

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- Start from **Abstract**: get a big picture.
- Go to **Conclusion**: focus on *achievement*.
- Then **Introduction**: catch the paper idea.
 - Motivation.
 - Previous work.
 - Problem to be solved.
 - Problem solving method.
 - Major outcome.
- Read the rest of the article if necessary.

Below is a good example [1].

1 Abstract

This paper presents a simple two-branch transmit diversity scheme. Using two transmit antennas and one receive antenna the scheme provides the same diversity order as maximal-ratio receiver combining (MRRC) with one transmit antenna, and two receive antennas. It is also shown that the scheme may easily be generalized to two transmit antennas and M receive antennas to provide a diversity order of $2M$. The new scheme does not require any bandwidth expansion any feedback from the receiver to the transmitter and its computation complexity is similar to MRRC.

2 Conclusion

A new transmit diversity scheme has been presented. It is shown that, using two transmit antennas and one receive antenna, the new scheme provides the same diversity order as MRRC with one transmit and two receive antennas. It is further shown that the scheme may easily be generalized to two transmit antennas and receive antennas to provide a diversity order of . An obvious application of the scheme is to provide

diversity improvement at all the remote units in a wireless system, using two transmit antennas at the base stations instead of two receive antennas at all the remote terminals. The scheme does not require any feedback from the receiver to the transmitter and its computation complexity is similar to MRRC. When compared with MRRC, if the total radiated power is to remain the same, the transmit diversity scheme has a 3-dB disadvantage because of the simultaneous transmission of two distinct symbols from two antennas. Otherwise, if the total radiated power is doubled, then its performance is identical to MRRC. Moreover, assuming equal radiated power, the scheme requires two half-power amplifiers compared to one full power amplifier for MRRC, which may be advantageous for system implementation. The new scheme also requires twice the number of pilot symbols for channel estimation when pilot insertion and extraction is used.

3 Introduction

The next-generation wireless systems are required to have high voice quality as compared to current cellular mobile radio standards and provide high bit rate data services (up to 2 Mbits/s). At the same time, the remote units are supposed to be small lightweight pocket communicators. Furthermore, they are to operate reliably in different types of environments: macro, micro, and picocellular; urban, suburban, and rural; indoor and outdoor. In other words, the next generation systems are supposed to have better quality and coverage, be more power and bandwidth efficient, and be deployed in diverse environments. Yet the services must remain affordable for widespread market acceptance. Inevitably, the new pocket communicators must remain relatively simple. Fortunately, however, the economy of scale may allow more complex base stations. In fact, it appears that base station complexity may be the only plausible trade space for achieving the requirements of next generation wireless systems.

The fundamental phenomenon which makes reliable wireless transmission difficult is time-varying multipath fading [1]. It is this phenomenon which makes tetherless transmission a challenge when compared to fiber, coaxial cable, line-of-sight microwave or even satellite transmissions.

Increasing the quality or reducing the effective error rate in a multipath fading channel is extremely difficult. In additive white Gaussian noise (AWGN), using typical modulation and coding schemes, reducing the effective bit error rate (BER) from 10^{-2} to 10^{-3} may require only 1- or 2-dB higher signal-to-noise ratio (SNR). Achieving the same in a multipath fading ...

Theoretically, the most effective technique to mitigate multipath fading in a wireless channel is transmitter power control. If channel conditions as experienced by the receiver on one side of the link are known at the transmitter on the other side, the transmitter can predistort the signal in order to overcome the effect of the channel at the receiver. There are two fundamental problems with this approach...

Other effective techniques are time and frequency diversity. Time interleaving, together with error correction coding, can provide diversity improvement. The same holds for spread spectrum. However, time interleaving results in large delays when the channel is slowly varying. Equivalently, spread spectrum techniques are ineffective when the coherence bandwidth of the channel is larger than the spreading bandwidth or, equivalently, where there is relatively small delay spread in the channel.

In most scattering environments, antenna diversity is a practical, effective and, hence, a widely applied technique for reducing the effect of multipath fading [1]. The classical approach is to use multiple antennas at the receiver and perform combining or selection and switching in order to...

Recently, some interesting approaches for transmit diversity have been suggested. A delay

diversity scheme was proposed by Wittneben [2], [3] for base station simulcasting and later, independently, a similar scheme was suggested by Seshadri and Winters [4], [5] for...

The technique proposed in this paper is a simple transmit diversity scheme which improves the signal quality at the receiver on one side of the link by simple processing across two transmit antennas on the opposite side. The obtained diversity order is equal to applying maximal-ratio receiver combining (MRRC) with two antennas at the receiver. The scheme may easily...

The new transmit diversity scheme can improve the error performance, data rate, or capacity of wireless communications systems. The decreased sensitivity to fading may allow the use of higher level modulation schemes to increase the effective data rate, or smaller reuse factors in a multicell environment to increase system capacity...

References

- [1] S. M. Alamouti, "A Simple transmit diversity technique for wireless communications," *IEEE J. Areas Commun.*, vol. 16, no. 8, pp. 1451-1458, Oct. 1998.