Adaptive real time wireless data transmission using superposition coding with feedback of channel state information

Abstract

High quality data transmission services are an important issue for broadband wireless access (BWA) systems. This paper deals with the design issues of a real-time wireless data transmission which provides unequal error protection (UEP) over an additive white Gaussian noise (AWGN) channel. Traditionally, transmission is made from a one bit stream at one level of power (for example, pulse amplitude modulation (PAM)) but using different techniques to exploit the available bandwidth. Using superposition coding, the real time data bit stream can be divided into two bit streams. The first bit stream represents the region of high priority (HP) while the second represents low priority (LP) region. These two bit streams are modulated separately, and superimposed together with two different levels of power to achieve the UEP at the receiver side. Feedback of the channel state information (CSI) is used by adaptive channel in the physical layer such that the current available bandwidth is used efficiently. In this proposed scheme, the same design metrics, namely time, bandwidth and power are used to increase the transmission efficiency. The performance of the proposed scheme is compared with the traditional, 2-PAM and 4-PAM schemes. Unlike the traditional schemes, the results show that our scheme provides a higher data rate at an acceptable bit error rate (BER) when the channel is in good condition. When channel quality is degraded, a reduced data rate is applied in contrast with the traditional schemes. As compared with the traditional 4-PAM scheme, the proposed scheme gives a good error performance for the HP bit stream with 0.2 dB gain increase at BER of 10-5, and exhibited a 4 dB gain when the channel condition is bad.

Keyword: Superposition coding; Real time transmission; UEP; CSI; AWGN