Performance of block turbo coded MIMO systems

Abstract

Wireless communication has been growing explosively in the last two decades according to the growing demand of high capacity and reliability communication link. Unfortunately, the amount of radio spectrum suitable for wireless communication is limited; therefore more sophisticated technologies have to be employed to make better use of the radio spectrum while providing reliable degree of services. One of major problems in wireless communication is its detrimental effects caused by multipath and movement in radio link. Telatar [I] and Foschini and Ganz [2] have been studied the information theoretic that showed the enormous capacity promised by multiple input multiple output (MIMO) systems in such channels. These capacity results have motivated new area in the design of channel codes. In their seminal paper. Tarokh et al [3] have been starting the development of channel codes for multiple antenna system which is called 'space-time codes' relied on the fact that these codes provided diversity both in space and time. The code design is based on trellis that it is called space-time trellis codes (STTC). Then Alamouti [4] proposed the full-rate space-time code for two transmit antennas scheme. This result was extended to higher number of transmit antennas based on orthogonal design [5]. But the resulted codes did not provide full rate transmission and coding gain although they were full diversity. In literature, both STTC and STBC were designed for quasi-static fading channels where the channels are constant over a frame of coded symbols. However, this assumption is rarely seen in wireless communication systems. There are many approaches to solve the drawback of the space-time codes when it is implemented in worse channel characteristic, such as fast fading channel where the channel varies in shorter period than the length of the frame of coded symbol. Some of the famous solutions are concatenated space-time codes with another channel codes, interleaver employment or using other channel codes as space-time codes, e g. space time turbo codes [6], and product turbo code [7,8].

In this paper, block turbo codes is a product code with iterative decoding using sub-optimum MLD algorithm [9]. We proposed a new product coded-MIMO schemes that provides space and time diversity over Rayleigh fading channel. The scheme is similar to [7,8], where the coded symbols are interleaved and converted from serial to parallel. In our scheme, the coded symbols are read in row, column and depth, for three dimension (3-D) product code, then transmitted

individually via different transmit antenna. These reading methods provide quasi interleaving to the transmitted symbols. The number of transmit antenna, corresponds to the dimension of the product code. The product code consists of linear block code as constituent codes with the same or different type and size. In particular, we use two transmit and two receive antennas with two-dimensional product code while three transmit and three receive antennas with three-dimensional product code. Performance of the system is analyzed through computer simulation and compared to the space-time block coding from orthogonal design [5].