

# **Performance Enhancement of Wireless Communication Systems Using Transmit and Receive Diversity**

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## **Abstract:**

In this paper, we describe the concatenation of Turbo/Convolutional codes with transmit and receive diversity schemes by using Space-Time Block Code. It is shown that, by using two transmit antennas and one/or two receive antenna, large coding gain for the bit error rate is achieved over the system without diversity. Simulation results show that, by using systems with transmit and receive diversity, high gain can be achieved with very low complexity. It turns out that at BER =  $10^{-4}$ , the gain of 9 dB can be achieved for system using STTD transmit diversity only (without using any channel codes) and 2 dB gain can be achieved over channel coding systems using hard-decision decoding with much lower complexity. The most important conclusion is that, using soft-decision decoding systems enhanced with transmit diversity can provide very high coding gain; e.g., in convolutional coded system using soft-decision Viterbi decoder, the coding gain is 12 dB over uncoded system and 5 dB over hard-decision decoding in flat fading channel, while the coding gain is about 13 dB for turbo coded systems using soft-decision decoding based on SOVA algorithm with transmit diversity and the coding gain is 15 dB if the decoder is based on Log-MAP algorithm. In systems using transmit and receive diversity, the coding gain is much higher, e.g., for convolutional-coded systems, the coding gain is 20 dB, while for turbo-coded systems using SOVA and Log-MAP algorithms, the coding gain are a little more than 20 dB and 21 dB, respectively.