PERFORMANCE IMPROVEMENT OF IMPERFECT POWER CONTROL IN CDMA SYSTEMS BY THE USE OF ANTENNA DIVERSITY RECEPTION

A. Kurniawan
Department of Electrical Engineering, Bandung Institute of Technology,
Jl. Ganesa 10, Bandung 40132, Indonesia
Tel. +62-22-250-1661, Fax. +62-22-253-4133, E-mail. adit@radar.ee.itb.ac.id

Code Division Multiple Access (CDMA) system is a promising access technology for the next generation wireless network. An important aspect of CDMA is that it requires tight power control to reduce multiple access interference among CDMA users. Closed loop power control has been implemented in CDMA to mitigate the effect of fading channel [1]. However in practice, signal fluctuation due to multipath fading can not be mitigated completely because power control algorithm is not perfect, particularly when the channel goes into deep fades. Fig. 1 shows the controlled signal-to-interference ratio (SIR) when the target level is set at 10 dB. We can see that power control error (deviation from the target SIR) is larger when fading is deeper because power control fails to track deep fades.

Another well known technique to reduce the effect of fading is antenna diversity, which has also been implemented in most wireless applications. In this paper we want to show that the effect of antenna diversity is twofolds: it reduces deep fades and at the same time it improves the performance of power control. Our preliminary investigation of such a combined technique has shown a promising result [2]. This can be explained that with antenna diversity, the probability of a channel going into deep fades can be significantly reduced, resulting in two major further improvements. Firstly, shallower fading dips become easier to be tracked by power control; and secondly, the system can be operated at lower peak transmit power resulting in less multiple access interference to other CDMA users. We will evaluate the performance of the combined technique in terms of bit error rate (BER) as a function of bit energy-to-interference power density ratio ($E_b/I_0$). It is important to note that although the BER performance of antenna diversity can be derived in a closed form, the BER performance of the combined technique is not exactly known. Therefore, computer simulations need to be conducted and we will show the results in the full paper.

Some References: