EFFECT OF FEEDBACK TRANSMISSION ERROR ON FIXED-STEP AND VARIABLE-STEP CLOSED LOOP POWER CONTROL IN CDMA SYSTEMS

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 will be a prominent access technology in the next generation wireless network because it can provide a higher capacity than other non CDMA systems [1]. However, wireless CDMA technique requires a tight power control in order to overcome the near-far problem and to mitigate the effect of signal fluctuation due to multipath fading. Uncontrolled fading channel significantly degrades the performance of CDMA systems because communication over fading channels require higher power levels, and thus producing higher unwanted multiple access interference among CDMA users. Our previous study of power control shows that practical power control is imperfect in that it is affected by many factors: power updating rates and step size, channel estimation error, feedback transmission error, and feedback delay. The work described in [2] shows that the effect of feedback delay on power control performance is very serious. In this paper the author investigates the effect of feedback transmission error. Such an investigation is important, because in practice feedback control bits are transmitted without error corrections (unprotected) and therefore are subject to high transmission error rates. The author evaluates the performance degradation of both fixed-step and variable-step power control algorithms due to the effect of feedback transmission error. Fixed-step power control employs a constant power-updating step size so that it requires only one control bit to adjust the transmit power at each power control interval, and hence minimizing the signaling bandwidth. As a result, fixed-step algorithm may not be able to quickly track the fading channel because it adjusts the transmit power step by step using a preset constant step size. Variable-step power control algorithm, on the other hand, employs variable step sizes to allow faster tracking of the channel using multiple control bits, and therefore it requires higher signaling bandwidth. The performance is evaluated in terms of bit error rate (BER) as a function of bit energy-to-interference power density ratio ($E_b/I_0$). Our preliminary result shows that the variable-step algorithm is more sensitive to feedback transmission error than the fixed-step algorithm as the performance of the former degrades more significantly for the same error rate of feedback transmission. This can be explained that erroneous control bits on the variable-step algorithm may result in a large power deviation, while in the fixed-step algorithm the resulting power deviation is limited by the fixed step size, which is usually preset at 1 or 2 dB. From this work, the author can infer that in addition to the lower requirement of signaling bandwidth, the fixed-step algorithm is also more robust against feedback transmission error compared to variable-step algorithm. We will show our final results of this work in the full paper.

Some References: