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OBSERVER BASED SLIDING-MODE POWER CONTROL FOR CDMA SYSTEMS

Hyungsuk Kim and Kwanho You

School of Information and Communication Engineering
Sungkyunkwan University, Suwon,440-746, Korea

Abstract. In this paper, we propose a sliding-mode power control algorithm for CDMA cellular communication systems. The new power control algorithm is based on linear quadratic control with a state observer. As an objective function, the accumulated variance of power and sum of power consumption is to be minimized with limited maximum power constraints. To compensate for the unmodeled dynamic errors caused by some fading effects, the sliding-mode surface is decided by following the solution of estimated state equation. Through a simulation comparison with the DCPC algorithm, the suggested power control scheme reveals that the faster convergence rate to target SIR can be attained with less computational iteration.

Key words: optimal power control, Kalman filter, CDMA, mobile communication, SIR, sliding mode.

1 Introduction

For CDMA cellular systems, one of the primary objectives of power control lies in the maximization of channel capacity, and in the improvement of quality of service (QoS). This can be accomplished through the fast convergence rate of transmission power and signal-to-interference ratio (SIR) to optimal power value and desired target SIR, respectively. The convergence rate of power control is especially important when propagation and traffic condition change rapidly. It is important to note that if an optimal power control can not be executed properly, near-far problem caused from different distances between base station and each mobile with a same transmission power may exist. Besides, there is a Rayleigh fading problem in which the transmission power of mobiles is decreased by the reflection from trees, buildings and so on. An efficient power control for wireless communication systems increases the channel capacity, decreases the power consumption of each mobile, and then extends a battery lifetime.

Much effort has been conducted to solve the power optimization problem. Zander [10], [11] has made a framework for power control problem in wireless cellular communications. Under the constraints of limited transmission power and less computational efforts for power update, Grandhi [4], [5] suggested a DCPC algorithm which includes the limited maximum transmission power of each mobile. Foschini [2] developed a simple but fundamental