MULTIUSER DETECTION USING TGA-BASED PARTIAL PARALLEL INTERFERENCE CANCELLATION FOR CDMA SYSTEMS

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ABSTRACT. *Conventional multistage multiuser detectors such as parallel interference cancellation (PIC) suffer from error propagation. Therefore, in this paper, we proposed an adaptive multistage Taguchi-Genetic-Algorithm (TGA) fuzzy-based PIC multi-user detector for direct-sequence code-division multiple-access (DS-CDMA) systems over additive white Gaussian noise (AWGN) channel and Rayleigh fading channel. Simulation results show that the proposed TGA fuzzy-based PIC multiuser detector not only can find an optimal partial cancellation weight (PCW) for the multistage PIC multiuser detector by using the measured signal-noise ratio (SNR) and signal's amplitudes, which reveal the reliability of the received signals but also can obtain both better performance and more robust results than the other detectors used in DS-CDMA systems. Furthermore, the TGA fuzzy-based PIC multi-user detector offers robust resistance against the near-far effect in DS-CDMA systems and always converges to the optimum solution with a small number of search stages.*
Keywords: Taguchi method, Genetic algorithm, Multi-user detection, Fuzzy inference system, Parallel interference cancellation

1. **Introduction.** It is well known that multiple access interference limits direct-sequence code-division multiple access (DS-CDMA) system capacity. Overview of different multiuser detection (MUD) methods can be found in [1] which using the MUD to overcome this performance degradation. The initial work on multiuser detection for CDMA is the optimal multiuser detector proposed by S. Verdu [2], which has potential for improvement in capacity and near-far resistance. Also, the optimal multiuser detector can eliminate the effect of the interference. The inherent complexity, however, increases exponentially with the number of users, rendering this optimal detector impractical. Due to its prohibitive computation complexity, numerous sub-optimal multiuser detection approaches have been under research to find a tradeoff between complexity and performance. Several suboptimal multiuser detection schemes have been proposed with the potential to significantly improve wireless communications [3-11,20-24]. One suboptimum, but less complex method is parallel interference cancellation (PIC) scheme introduced in [3] that can be