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SUBCARRIER AND BIT ALLOCATION SCHEME FOR THE MA PROBLEM BASED ON THE ANT COLONY OPTIMIZATION TO MINIMIZE POWER CONSUMPTION IN OFDMA SYSTEMS

Jungsup Song and Dong Hoi Kim*

School of Information Technology
Kangwon National University
192-1, Hyoja-Dong, Chuncheon 200-701, Republic of Korea
songjs@kangwon.ac.kr; *Corresponding author: donghk@kangwon.ac.kr

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Abstract. *Subcarrier and bit allocation for margin adaptive (MA) problem with goal of minimizing the transmit power consumption under a given requirement has become an important issue for providing efficient power saving design in downlink orthogonal frequency division multiplexing access (OFDMA) systems. However, the problem becomes NP-hard because it requires a great complex searching facility to find a bit and subcarrier combination which performs the best. To find the best combination without a full search, we propose an efficient subcarrier and bit allocation scheme for the MA problem based on the ant colony optimization (ACO) algorithm minimizing transmit power consumption with satisfaction of required bits. Simulation results show the proposed ACO based scheme provides better performance in terms of less transmit power consumption and faster convergence.*

Keywords: OFDMA system, Subcarrier and bit allocation, Ant colony optimization, Genetic algorithm, Transmit power minimization

1. **Introduction.** Subcarrier and bit allocation has been studied for a diversity of OFDM-based communication systems because of its benefit in terms of efficient use of the given frequency as well as power resources [1-3]. In particular, power-efficient design of a subcarrier and bit allocation algorithm with low transmit power while satisfying given throughput and fairness requirements is an important issue because, with low transmit power, the inter-cell interference (ICI) can be lowered in cellular OFDMA systems.

In the previous studies, there are optimal and suboptimal algorithms presented for downlink OFDMA systems that adaptively allocate the subcarriers and bits for multiple users [4-9]. Among them, [4, 5] formulated nonlinear optimization problems adopting integer variables, known as the margin adaptive (MA) and rate adaptive (RA) problems. The MA problem is to minimize the total transmission power under a given rate requirement, and the RA problem is the maximization of the data rate under a given maximum transmit power requirement. Since solving the optimization problem requires extremely high computational complexity because of the search space exponentially increasing with the number of subcarriers and users, suboptimal algorithms were also proposed, including the greedy algorithm for multi-user multicarrier systems [6-9]. Particularly, the subcarrier and bit allocation scheme for the RA problem based on the ant colony optimization (ACO) algorithm was introduced in [10].

This paper proposes a novel subcarrier and bit allocation scheme for the MA problem based on the ant colony optimization (ACO) algorithm to minimize power consumption in OFDMA systems. An important contribution of this paper is that the ACO algorithm is adapted to subcarrier and bit allocation of an OFDMA system for the MA problem,