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DOWNLINK MIMO-SDMA OPTIMIZATION OF SMART ANTENNAS BY PHASE-AMPLITUDE PERTURBATIONS BASED ON MEMETIC ALGORITHMS FOR WIRELESS AND MOBILE COMMUNICATION SYSTEMS

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Abstract. *In this paper, based on memetic algorithms by using phase-amplitude perturbation method, an innovative downlink Multiple-Input Multiple-Output Spatial Division Multiple Access (MIMO-SDMA) optimization technique of smart antennas is proposed. The radiation pattern formulas available for searching optimal solutions are deduced to search the optimal weighting vector of the array factor of a smart antenna. In a smart antenna system, one user's signal must be considered as other users' interfering signals. An optimal radiation pattern of a smart antenna can not only adjustably suppress interferers by placing nulls at the directions of the interfering sources but also provide maximum main lobes in the directions of the desired signals at the same time, i.e., to maximize the Signal to Interference Ratio (SIR). In order to achieve this goal, a new convergent method referred as the two-way convergent method for memetic algorithms is proposed. The characteristic is that the optimal radiation pattern design of smart antennas is studied by phase-amplitude perturbation method to achieve MIMO-SDMA optimization.*

Keywords: Downlink, MIMO-SDMA, Optimization, Smart antenna, Radiation pattern, Weighting vector, Memetic algorithms, Phase-amplitude perturbations

1. **Introduction.** Owing to the amazing development of computers, applying modern numerical optimization techniques to optimal radiation pattern design is becoming possible. Memetic algorithms are used to search the optimal weighting vector of the phase-amplitude perturbations. Compared with nulling or main lobe designs, the optimal radiation pattern design brings different convergent criteria for optimization problems. That is, it should not only suppress the interferences in their directions but also enhance the main lobe towards the desired signal's direction [1-4]. The MIMO-SDMA technique can offer two or more subscribers to use the same base station at the same time, frequency and code multiple transmission technologies. The capacity of communication can be increased by the MIMO-SDMA technique [5]. The simulation results show the effectiveness of the memetic algorithm for this kind of optimization problem. The optimization design of a smart antenna has been limited to adjust the main lobe of radiation pattern towards the users. But, it is not good enough for the practical wireless communication. In the practical wireless communication, it must not only maximize the main lobe toward the direction of the desired signals, but also suppress interferences by placing nulls in the directions of interfering signals in the smart antenna radiation pattern. Thus, Spatial Division Multiple Access (SDMA) can be really come true. In a smart antenna system, there will be several signals use a co-channel at the same time. Therefore, these signals