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OPTIMIZING MIMO-SDMA SMART ANTENNAS BY USING LINEAR ARRAY PHASE PERTURBATIONS BASED ON PARTICLE SWARM OPTIMIZATION

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Abstract. *In this paper, based on phase-only perturbation method, an innovative uplink Multiple-Intput Multiple-Output Spatial Division Multiple Access (MIMO-SDMA) optimization technique of smart antennas by is proposed. Particle swarm optimization (PSO) algorithm is used to search the optimal weighting vector of the phase shift perturbations for array factor. The deduced radiation pattern formulas available for searching optimal solutions are used to search the optimal weighting vector of the array factor of a smart antenna. The design for 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 particle swarm optimization is proposed. The optimal radiation pattern design of smart antennas is studied by phase-only perturbation method to achieve uplink MIMO-SDM optimization.*

Keywords: Multiple-intput multiple-output, Spatial division multiple access, Smart antennas, Linear phase array, Particle swarm optimization

1. **Introduction.** The advent of fast and low-cost digital signal processors has made smart antennas practical for cellular land or satellite mobile communication systems. Therefore, the study of smart antenna systems is becoming the interest of engineers and researchers in the communication field. The goal is to improve the system performance by increasing channel capacity and spectrum efficiency, extend range coverage, steer multiple beams to track more mobiles, suppress multipath and co-channel interferences for signal propagations [1].

PSO algorithm combines the advantages of efficient heuristics incorporating domain knowledge and population-based search approaches to solve the optimization problems. In PSO algorithm, each single solution is a "bird" in the search space. It is called "particle". All of particles have fitness values which are evaluated by the fitness function to be optimized, and have velocities which direct the flying of the particles. The particles fly through the problem space by the current optimum particles. Particle swarm optimizations are used to search the optimal weighting vector of the phase-only perturbations of array factor [2]. Compared with nulling or main lobe designs, the optimal radiation pattern design brings different convergent criteria for optimization problems [3-6]. It must not only suppress the interferences in their directions but also enhance the main lobe towards the desired signal's direction. The simulation results show the effectiveness of the particle swarm optimization for this kind of optimization problem. The optimization