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Research Article

Multi-Objective Optimization Algorithm Development Using Chaotic Maps to Design of a Planar Microstrip Monopole Antenna

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Abstract

This research uses a new multi-objective optimization algorithm to design a single pole antenna with specific electromagnetic characteristics. This algorithm uses a hybrid chaotic function to integrate the customized mutated particle swarm algorithm with the modified genetic algorithm. By avoiding getting trapped in local minima, the new hybrid approach achieves desired results faster than conventional particle swarm algorithms and genetic algorithms. The performance of the proposed meta-heuristic algorithm has been successfully simulated and stabilized using benchmark functions. Finally, the validity of the proposed approach for electromagnetic applications is demonstrated by optimizing a planar microstrip monopole antenna with a simple structure, so that its optimized S_11 is less than -10 dB in the frequency band of 3.3 to 3.8 GHz and below. It is from -40 dB at the resonance frequency of 3.5 GHz with the applications of the N-78 frequency band of the fifth generation of NR. The proposed algorithm allows the optimization criteria to be customized to achieve the predetermined results for return loss and resonance frequency. The optimization algorithm developed in MATLAB is used to determine the necessary parameter settings in order to achieve the expected frequency bands using custom mutated particle swarm algorithm or heuristic modified genetics.

Keywords: Optimization Algorithm, Chaotic Map, Monopole Antenna, PSO, GA.

Highlights

- Combining metaheuristic algorithms using chaotic maps by avoiding the combination difficulties.
- Improving the performance of classical Genetic Algorithm.
- Developing a multi-objective hybrid optimization algorithm with better performance.
- A novel design of monopole antenna.

Citation: (in Persian).