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CPW-FED MONOPOLE ANTENNA CHARACTERIZED BY USING PARTICLE SWARM OPTIMIZATION INCORPORATING DECOMPOSED OBJECTIVE FUNCTIONS

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Abstract. *A systematic design strategy for Co-Planar Waveguide fed (CPW-fed) monopole antennas is developed in this work by using an improved Particle Swarm Optimization (PSO) to determine the optimized values of an equivalent circuit's components. The impedance response on the desired frequency band can approximate that of the antenna at the feed point. Owing to the problems of information deficiency in the objective function, optimized results via conventional PSOs generally have failed to satisfy the expected requirements. An improved PSO incorporating a Decomposed Objective Function (PSO-DOF) is therefore proposed to overcome this problem. The objective function is first decomposed into a number of portions by using a set of weighting functions, and then each decomposed portion is used to evolve a corresponding group of factors in a particle. Because of the results optimized via the proposed PSO-DOF, the relationship between the antenna geometrical dimensions and circuit components can be established as a guideline for adjusting the antenna configuration to meet the desired specifications. Simulation results have demonstrated that the PSO-DOF is superior to the other PSO schemes in characterizing an equivalent circuit of a CPW-fed monopole antenna at the feed point, and successfully addressing the issue of information deficiency in the objective function.*
Keywords: CPW-fed antenna, Particle swarm optimization, Decomposed objective function, Equivalent circuit

1. **Introduction.** There has been a remarkable growth in the design of wireless communication systems over the past decades, where many functions are integrated into a single module. With the growing trend toward miniaturization of components, the issues of the integrations and profiles of components have increasingly received much attention. For instance, antennas used for wireless communication applications need to operate at high frequencies and multiple frequency bands to meet the requirements of versatile communication functions. As a result, difficulties arise in the design of such antennas because of the specifications of wide frequency bandwidth and multiple frequency bands.

Though an antenna with an inverted-F configuration has the features of low profile and miniaturization, it generally fails to meet the requirements of multiple frequency bands and wide bandwidth. To overcome this bottleneck, an antenna with a sophisticated configuration can be adopted. This, however, inevitably causes difficulties in the fabrication of antennas from the view point of mass production. Coplanar monopole antennas, on the other hand, are capable of providing bi-band or multi-band operations. Unfortunately, the feed signals are acquired via holes connecting the ground implemented on the opposite side of the substrate, which generally increase cost and complexity in the manufacturing process. Alternatively, a chip antenna is another design scenario to be considered.