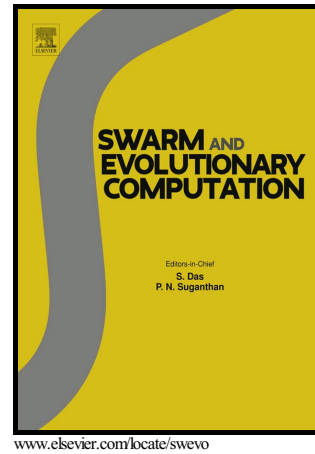


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# Evolutionary Algorithms Based Synthesis of Low Sidelobe Hexagonal Arrays

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**Abstract:** In this work a procedure namely Findpeaks2 is proposed to detect the maximum sidelobe level (*SLL*) from the samples of three dimensional radiation pattern. This procedure detects all sidelobe peaks from the samples of the radiation pattern in the entire visible region. For illustration, a low sidelobe radiation pattern synthesis problem is formulated for two concentric regular hexagonal antenna array (CRHAA) geometries, having 6- and 8- rings. To verify the extent of applicability of the proposed procedure, both broadside and scanned array configurations are considered. Feed current amplitudes are considered as the optimizing variables. Two variations of current distributions are considered, i) identical feed for all the elements on a ring (hence the one variable per ring needs to be optimized), and ii) asymmetric excitation distribution (set of excitation amplitude of all elements as optimizing variables). The design objective has been considered to optimize the radiation patterns with very low interference from the entire sidelobe region. To restrict the fall of directivity value, a constraint on the lower limit of directivity value is considered. The impacts of symmetry and the constraint on directivity on the search of these algorithms are studied. Evolutionary algorithms like Real Coded Genetic Algorithm (RGA), Firefly Algorithm (FFA), Flower Pollination Algorithm (FPA), an adaptive variant of Particle Swarm Optimization Algorithm namely (APSO), and two recently proposed variants of DE namely Exponentially Weighted Moving Average Differential Evolution (EWMA-DE), and Differential Evolution with Individual Dependent Mechanism (IDE) are employed for this pattern optimization problem.

**Keywords:** Concentric regular hexagonal antenna arrays, interference suppression, directivity, evolutionary algorithms, constraint handling, real coded genetic algorithm, differential evolution, particle swarm optimization, firefly algorithm, flower pollination algorithm.

## 1. Introduction:

In the noisy environment, the peer-to-peer communication systems, the broadcasting systems or the conference systems suffer pathetically due to high interference [1]. Naturally, antenna synthesis towards suppressing high interference so as to improve the reception quality has become one of the major antenna design objectives. Antennas are the terminal equipments of a wireless communication system, which radiates and receives electromagnetic waves [2]. Hence, spatial interference rejection is possible by suitably designing antennas [3]. Beam forming networks have added a degree of freedom in antenna engineering; consequently, synthesis of antenna arrays is popular among antenna engineers owing to the flexibility in beam shaping and steering applications.

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