Linear Antenna Ensemble from the Genetic Algorithm Optimization of a Log Periodic Dipole Array

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With the evolution of increasingly more powerful computers, optimization with genetic algorithms within the electromagnetic community has become widespread and robust. In addition to technical knowledge, intuition is helpful for an efficient and effective antenna design, although intuition has been difficult to garner in computational processes due to limitations in display tools. In lieu of intuition, genetic algorithms can define and search a large design space, resulting in an unintuitive and yet very effective antenna product.

This paper presents a technique to optimize antennas whose origins are Log Periodic Dipole Arrays (LPDA). We used a genetic algorithm from an automated optimization program (iSIGHT) to iterate on an input file for a method of moments code to model antennas (GNEC). The technique is compared to similar work with Yagi-Uda antennas, and then progresses to define and find optimal antennas whose motivation is LPDA.

We have preliminary results of 107.7% improvement in the main lobe gain for our studies focusing on the Yagi-Uda antennas of [Lohn JD et al, Fourth International Conference on Evolvable Systems, Oct 2001: 236-243]. Our work on shows promising results at more than 200% improvement in main lobe gain from the original design.

In addition to main lobe gain, the Voltage Standing Wave Ratio (VSWR) values for each observed frequency are used as criterion to select the potential winner from the automated optimization program - the goal being to minimize the VSWR across the respective frequency band. This not only contributes to the antenna's performance but also toward its merit in specific applications.