

“Synthesis of Linear Antenna Array using BBC Algorithm for Wi-Max Technology”

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Abstract— In this research Big bang crunch optimization algorithm is used for the synthesis of broadside and end-fire linear antenna array. The radiated power of antenna elements is calculated with the help of optimum value of currents which produce minimum side lobe levels. Big bang crunch (BBC) algorithm used to calculate the optimum value of current which reduces the side lobe levels, enhanced the beam width and directivity of radiation pattern for WI-MAX technology, as compare to real code genetic algorithm (RCGA) and Simulation done by using MATLAB which show better results in Big bang crunch method as compare to others.

Key words: Linear Antenna Array, Array Factor, RCGA, BBC, Cost Function, Fitness Function WI-MAX

I. INTRODUCTION

The power patterns with low SLL are desirable in many application in the field of communication system like mobile, wireless and satellite application. In many communication system, Point to point communication is used, For this highly directive beam of radiation is required. With the advent of technology and recent developments in communication wireless communication has reached to new level recent updates in wireless communication were not possible without application of smart antennas. Use of smart antenna is one of the vital characteristic that has lead to the third and fourth generation standard developments. With antenna pattern synthesis there comes speed and Robustness to existing system there by improves transmission parameter. Along With the radio wave propagation is a matter of research that account faster and reliable transmission, since wireless is generated from the roots of radio communication. [7]

II. THOERY

In this section a brief introduction of optimizing algorithm BBC, Steps of BBC, Parameter of BBC formation of cost function or fitness function have been defined.

A. Optimization Algorithm

Big-Bang crunch (BBC), a heuristic optimization method is based on the concept of universal evolution. Fire Fly optimization (FFO), also a recent heuristic optimization method, is based on the concept of flashing behaviour of lighting bugs. Both the optimization methods are applied to obtain the solution of the Optimal Power Flow (OPF) with continuous and discrete control variables for quadratic generator output cost functions. [1]

Big Bang Big Crunch algorithm involves the steps shown below in reactive power flow control. [2]

- 1) Step 1: Form an initial generation of NP candidates in a random manner respecting the limits of search

space. Each candidate is a vector of all control variables, i.e. [Pg, Vg, and Tk]. There are 5 Pgs, 6 Vgs, and 4 Tks in the IEEE-30 system and hence a candidate is a vector of size 1x15.

- 2) Step 2: Calculate the fitness function values of all candidate solution by running the NR load flow. The control variable values taken by different candidates are incorporated in the system data and load flow is run. The total line loss corresponding to different candidates are calculated.
- 3) Step 3: Determine the centre of mass which has global best fitness using equation (9). The candidates are arranged in the ascending order their fitness (fitness) and the first candidate will be the candidate with best fitness (minimum loss).
- 4) Step 4: Generate new candidates around the centre of mass by adding/subtracting a normal random number according to equation (10). It should be ensured that the control variables are within their limits otherwise adjust the values of „r and „a.
- 5) Step 5: Repeat steps 2-4 until stopping criteria has not been achieved.

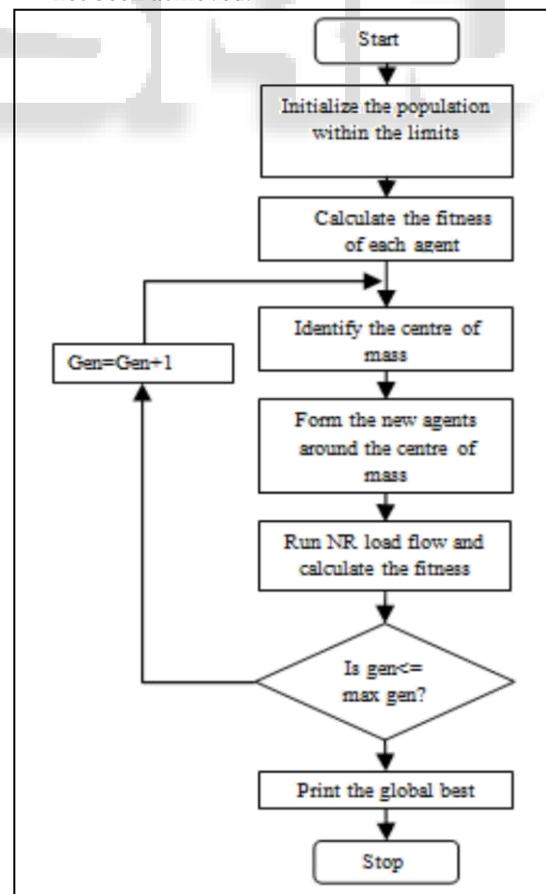


Fig. 1: Flow Chart of BBC [2]

| S.NO | Parameter | Value |
|------|----------------------------|------------------------------|
| 1. | Frequency of operation | 3.3Ghz |
| 2. | Spacing between elements d | 4.5 cm |
| 3. | Phase between two elements | 0 Radian |
| 4. | No. Of elements | 5 |
| 5. | output parameter | SLL, Directivity, Beam width |

Table 1: Parameter for BBC

III. SIMULATION RESULTS

To illustrate the technique described above, spacing between elements is 4.5cm, frequency of operation 3.3 GHz, phase between two elements is 0 Radian, and 5 elements are considered. With the help of BBC algorithm SLL, directivity and beam-width are determined.

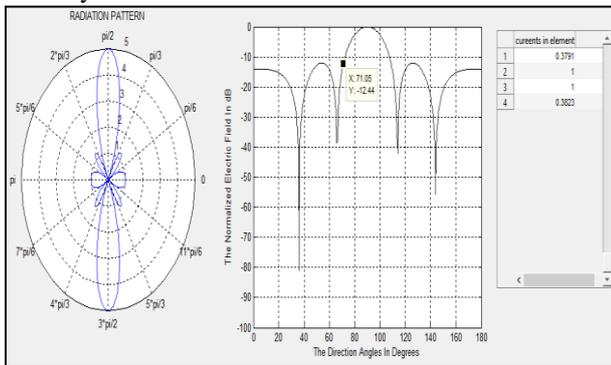


Fig. 2: Unoptimized Radiation Pattern With Reduce Side Lobe Level for N=5 Element

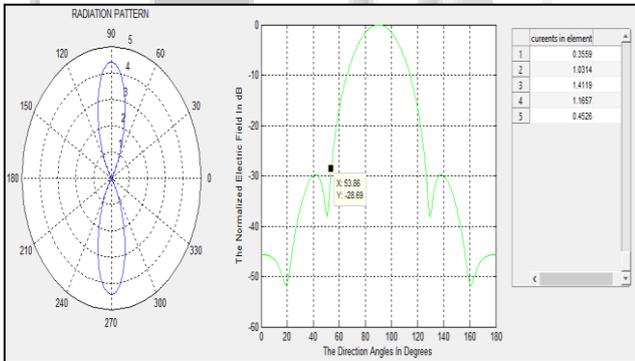


Fig. 3: Optimized Radiation Pattern With Reduce Side Lobe Level -29.8046db for N=5 Element

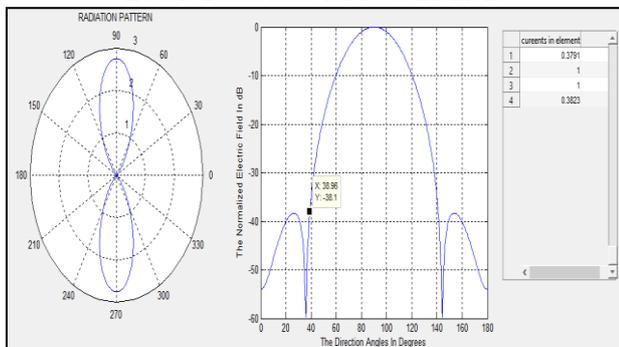


Fig. 4: Optimized Radiation Pattern With Reduce Side Lobe Level -38.318db for N=5 Elements

| S.N O | Parameter | Without optimization | RCGA | BBC |
|-------|--------------------------|----------------------|---------|----------|
| 1 | Side Lobe Level (in db) | -12.0442 | -29.804 | -38.318 |
| 2 | Directivity (in db) | 12.389 | 11.711 | 11.2745 |
| 3 | Beam Width (in degree) | 12.44 | 28.69 | 38.10 |
| 4 | Convergence time(in sec) | | 10.498 | 44.17sec |

Table 2: Comparison between RCGA & BBC

IV. CONCLUSION

In this paper, BBC optimization algorithm is successfully introduced in linear antenna array synthesis for WI-MAX. BBC is applied to calculate the optimized value of currents is achieved which minimize side lobe levels. The reduction in radiated power increases the directivity of radiation pattern. These results are compared with other optimizing techniques such as GA and PSO which shows that BBC exhibits good performance in terms of accuracy and convergence time. Hence BBC provides better result than other optimizing techniques in WI-MAX.

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