Chapter 10

Conclusion and Future Scope of Research

In this thesis, attempts have been made to fulfill three categories of array synthesis techniques such as narrow beam synthesis, beam synthesis by placing the nulls and sector beam synthesis are performed using optimization methods to overcome the limitations of the classic arrays. Throughout the thesis, for every array design, 18GHz is considered as the operating frequency and minimum one third wavelength distance is maintained between array elements.

The major contributions of the thesis are:

1. In this thesis it was explored in detail application of phased array antenna in every kind of array synthesis methods due to its various advantageous features which are found suitable for modern communications.

2. In this research work to overcome limitations of classical array synthesis methods, Genetic Algorithm and Particle Swarm Optimization are incorporated in the phased array technology.

3. Phased array synthesis for lower side lobe level is performed in both way by finding optimum amplitude distribution and by thinning of array without distorting the main beam. Array thinning provides an extra advantage for simplified array feeding network design and lowering the continuous power radiation all time.

4. Optimization of phased Tchebyscheff array is performed by blending this array synthesis technique with optimization techniques which results narrow beam like Tchebyscheff array with lower SLL at any desired direction. Optimization of phased Taylor array is performed to determine an optimum excitation amplitude distribution that resulted reduced SLL than Taylor Array at desired direction.

5. Binomial array becomes unsuitable for practical use due to high variation of feeding current. This research work proposed an optimized binomial array which is produce lower SLL for increased element spacing and also excitation current ratios are minimized.
6. An optimized Schelkunoff array synthesis is suggested which can place the nulls according to desire direction and also generate a beam towards intended user with lower SLL whereas Schelkunoff array alone has no control on side lobe level.

7. Wide Flat-top sector beam with high gain is required for cell-sectorization in mobile communication which is generated by optimization techniques as the classical methods Fourier Series and Woodward-Lawson produced beam pattern with ripple and without beam steering facility.

8. An optimized Phased aperiodic array synthesis is suggested having average element spacing more than half wavelength which not only able to eliminate Grating lobes also able to reduce SLL.

Mutual coupling between the antenna arrays is not considered, which is one of the limitations of this work. In all the cases isotropic elements are considered. Also the optimized array synthesis not investigated for other form of arrays, like, planar array or circular array.

Future scope of research work may include:
Optimized array synthesis for directive antennas will be considering mutual coupling between antenna elements. Array synthesis problems currently proposed by global search optimization methods are very time consuming, that can be made faster by application of convex programming. Though PSO/GA optimization methods can produce very good results but these techniques are suitable for off-line process only. Future work may be real time array synthesis for practical applications. Simulation done for proposed array synthesis are considered for linear arrays with less elements; to increase directivity and more compact design planar and conformal array design will be a good choice. Antenna structures with multi-octave capability provides very large wide band found useful for modern communications systems; it can be designed by randomly spaced antenna arrays in spiral or biconical form.