Optimization of Antenna Parameters Using Artificial Neural Network: A Review

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Abstract- *Microstrip Patch antenna is used in various antenna systems because of their low profile, light weight, low cost, compactness etc. Patch antenna is also used with Microwave IC's and Monolithic Microwave IC's because of its compatibility. Artificial neural network have become popular for predicting performance parameters of various antenna because of their learning and simplification features. The use of neural networks can considerably diminish the complexity. An upfront application of an artificial network consumes the information resulting from the composite measured processes to train an ANN. After appropriate process of training, these network representation can be considered in place of computationally exhaustive representations in order to hurry up the investigation. Various neural network training algorithm were used by the researchers to optimize the parameters of various antenna and to obtain the accurate results in less time. In this paper, we have made a study and survey on various antenna designs parameters using artificial neural network.*

Keywords: *Microstrip, ANN, Gradient Descent, MoM, Levenberg-Marquardt Back propagation*

I. INTRODUCTION

Antenna is a device that is used to radiate electromagnetic energy in desired directions, either omni-directional; semi-directional and directional antennas are used. Antennas are used to redirect the radio frequencies provided by the transmitter to the receiver in free space [1]. Antenna is required to cover various frequency bandwidth or wide frequency band. It was expected that the antenna size should be small and its performance can be affected by changing the geometries of mounting devices [2]. Now a day, demand for low cost antenna can be accomplished by reduced size and compressed architecture. Microstrip antenna have several benefits when compared to supplementary antennas such as low weight, low cost, low profile, low scattering cross section, option of undeviating and rounded polarization with particular feed and can be simply incorporated for microwave circuits [3]. There are numerous procedures for investigation of microstrip antenna. The popular procedures are transmission line, full wave and cavity. The earliest among the all is transmission line model because of good physical insight. The design procedure assumed that information which includes the dielectric constant of the substrate (ε), the resonant frequency (f) and the height of the substrate (h) [4]. A microstrip antenna is well-defined according to an array of dual radiating contracted apertures, each of height h, width w and separated by a distance L. The antenna design procedure is as follows:

A practical width of the patch that leads to good radiation efficiencies is given as

$$w = \frac{1}{2f\sqrt{\varepsilon_0\mu_o}}\sqrt{\frac{2}{\varepsilon+1}} \quad (1)$$

where $\varepsilon_o\mu_o = c$,= 3×10^8 m/s and f defined resonant frequency.

Effective dielectric constant of antenna for w/h > 1 is given as

$$\varepsilon_{reff} = \frac{\varepsilon+1}{2} + \frac{\varepsilon-1}{2}\frac{1}{\sqrt{1+12\frac{h}{w}}} \quad (2)$$

The antennas have been designed for given application according to the required performances. Nowadays the task was to catch the available symmetrical factors of the patch (like dimensions of patch, dimensions of ground and feed position) that consumes a portion of time due to trial and error practice. To decrease this consumption of time, vast amount of techniques were used (such as optimum algorithms, ANN techniques etc).

Soft computing provides solution to compute hard task. It is used where the algorithm is not known that can simulate an exact solution in less time. It differs from conventional computing due to tolerance of imprecision, partial truth and uncertainty to achieve robustness, practicability and low computation cost. In effect, it works as a human mind. Soft computing is used when enough information is not known about the problem. Soft computing eliminates the use of complex mathematical system and provides the solution in less time. Soft computing is a biological inspired techniques rather than a single methodology. These techniques are used during complex problems that require repeated analysis.

Now days, these techniques in antenna design and optimization have achieved faster convergence. Soft computing methods can be broadly classified as: Fuzzy logic, Artificial Neural Network, Evolutionary Algorithm.

An artificial neural network is an immensely comparable extended processor that has a common tendency for storing practical information and creating it accessible for usage. It look like the mind in two respects: information is attained by a net over a learning procedure, and neuron linking assets are identified as synaptic loads that can be used to store the observed knowledge." It has been observed that in dynamic era, artificial neural network has exceptional contributions and important advancement in the field of wireless communication.

ANN is a model operated as a biological neural networks which are used to estimate the functions that are largely depend upon the large number of inputs which are generally unknown. ANN is well-defined as a "calculating system prepared by number of unpretentious, highly organized handling elements, which processes data by their vibrant state reply to exterior inputs. "Artificial Neural network are the simplified model of neural processing that are used as artificial intelligence in the brain [5].

They can perform many tasks such as system identification, adaptive control, function approximation and optimization. A neural network yields some features like distributed association, ability to handle imprecise data and nonlinear mapping. In ANN, hidden patterns can be found out from the training data sets. It provides the results with minimum MSE and can provide non-linear relationship without any need of existing models. ANN can perform many tasks such as system identification, adaptive control, function approximation and optimization. A neural network yields some features like distributed association, ability to handle imprecise data and nonlinear mapping. In ANN, hidden patterns can be found out from the training data sets. It provides the results with minimum MSE and can provide non-linear relationship without any need of existing models. The main advantage of ANN are that the Network can solve complications without relating any technique of such problematic solving, without constructing any algorithms, and also without any individual information about the nature of solved problem [6].

Neural networks applications are based on software solutions. The learning difficulty in neural networks was expressed in relations to the minimization of loss function. This function is collection of an error and a regularization terms. The error term estimates how a neural network fits the data set and the regularization term is used to avoid the overfitting, by controlling the complexity of the network [7].

Training algorithm can be observed as a function approximation problem to adjust the parameters and to minimize the error function between the network output and the desired output. The GD algorithm is used to reduce the mean square error for the model between the output and the desired output. The model error can be reduced to particular threshold level, then the model is said to be trained [8]-[9]. It updates the synaptic weights for the negative gradient of energy function.

Resilient Back Propagation (RP) is used to overcome the effect of updating the negative gradient by performing the local weight updating by the behavior of the error function. The reaction of the adaptation process is not damaged by derivative size, but by the temporal behavior of its sign. Resilient Back propagation is much faster when compared to steepest descent algorithm as it provides a modest increase in memory requirements. Levenberg-Marquardt Back propagation (LM) provide improved conjunction effects than ordinary back propagation algorithm, it needs $O(N2)$ storing and calculations of instruction $O(N2)$ where N is the entire number of masses in back propagation algorithm [10]. The LM training process is actual profitable when the training has done up to rare hundred masses and much higher computation is required for each iteration to provide high precision.

II. Artificial Neural Network

Most common ANN training algorithm used is the Back Propagation which is also known as error back propagation based on error correlation learning rule. It maps input onto the output data. Back propagation consists of 3 or more layers with each connected to the other one. It operates in such a manner that output of first layer will work as input to another one and this connection process will continue till the end [11]-[12]. The ANN is the data processing models comprising of nodes known as neurons and the connection between the neurons is called weights. Weights are used for determining the output of neurons, higher the weight of the link stronger effect will be provided by the input

In the given sections, neural network application is used for designing of various antennas. In this article the references are chosen according to the technology and design parameters.

Neog el at. [13] investigated the Multi-slot hole-coupled Microstrip antenna with multi-frequency characteristics to achieve wide bandwidth. This antenna has complex geometries and difficult to design therefore, ANN is used to calculate the radiation pattern. They suggested the use of Genetic Algorithm to fix the initial weights of a

multilayer perceptron network for faster convergence, by coupling of GA with ANN to select the initial weights. This antenna show simplicity and flexibility in controlling the bandwidth with high isolation between frequency bands. ANN technique with tunnel-based model provides less computation time and more accurate results. Tunneling is achieved by the condition that any unit located at a lesser perturbation from the equilibrium point will travel away from the existing point to another point within an infinite amount of period. GA was used for coupled technique, which provide great amount of accuracy in small computation time and it also reduces the simulation time by half. The comparison between the experimental results, theoretical results and results by Genetic Algorithm technique is shown in Fig. 1. The comparison shows that the GA technique provide the accurate results for resonant frequency very easily and with less computation cost.

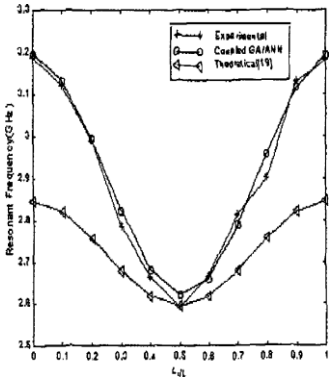


Fig. 1 Rectangular microstrip patch antenna with a shorting post and graph showing resonant frequency of the tuned antenna as a function of the post position [13].

Heriberto al. [14] presented a novel network for optimization of antenna with respect to VSWR, bandwidth and operational frequency. ANN exploits an exclusive representation of input and output data in concurrence with a usual neural network architecture. ANN consist of hetroassociative memory which provide an efficient process of calculating geometrical standards of antenna. Novel ANN model mechanically retains itself during the investigation of solution subspace by randomizing input and output. Randomization allow to generate training data set if it is unseen by the user. ANN technique provide time and cost saving and minimizes the processing requirement by dropping the amount of times the device is being used. A fault scheme allow fast convergence and provide creative solutions with reduces the iteration synthesis. The new model ANN model is flexible, defines random number of input and output and rises the number of grade in search for solution. If amount of inputs and outputs can be varied than modified bow-tie antenna can be designed. Fig 2 shows the measured VSWR information with good arrangement between the calculated and measured information as the theoretical model was authenticated against the measured data from an antenna model. The investigation instrument FDTD requires 98.5% of Central processing unit time but ANN has used 1.44% of CPU time throughout training and synthesis.

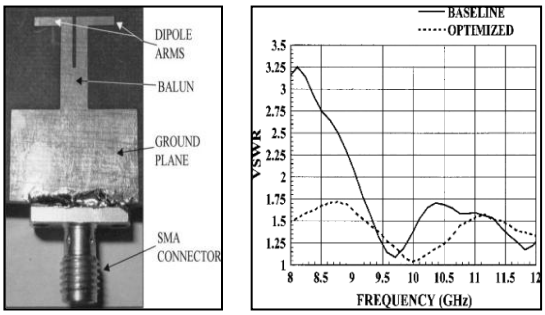


Fig. 2 The printed dipole antenna structure and plot showing measured VSWR versus frequency (GHz) for optimized and baseline printed dipole antennas [14].

Patnaik et al. [15] proposed a model for locating faults in Antenna Array using Artificial Neural network. When Antenna Array is used in communication system many radiating elements are needed and there is probability that one or more radiating elements may be failed. Failure in antenna may destroy the symmetry and cause pattern distortion. ANN is used for resulting out the location of fault element. ANN also provide the advantage to bypass the iterative process after obtaining trained network. Multi-layer perceptron Back propagation model is used for mapping the impaired radiation design with the position of faulty elements in the Antenna collection. When ANN is used at the base station it will find the amount and position of faulty features in the array. The network output is rounded off to get the fault element and its position. Fig. 3 display that an output of .397, produce the value 0.4, which means that the fault is in 4th element. This methodology is tested for linear array as well as for planar array to provide results which provide good agreement with simulated results.

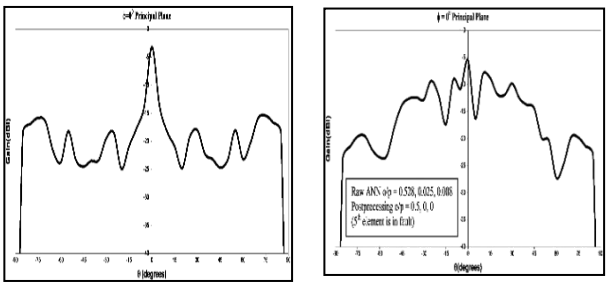


Fig. 3 Simulated radiation pattern without faulty elements and fault element pattern with the equivalent ANN output in the inset [15].

Selvan et al. [16] investigated the spiral strip monopole antenna design which is served by the coplanar waveguide for radio frequency identification application using neural network model. In RFID system, a reader transmit RF power to device, which then direct the coded signal and reader can modify the information. RFID antenna must be designed to reduce the cost and must be of small size. ANN is used in real time operation because of its simplicity and generation ability. CPW fed monopole antenna symmetrical parameters are shown in Fig. 4 to provide low radiation loss, less dissipation and easy to integrate with RF components. When antenna is excited at 5.8GHz, LM-ANN provide the peak antenna gain and bandwidth of 4.51dBi and 23.28%. ANN model yields factors of CPW fed monopole antenna by excluding the time consuming procedure and when excited at 50Ω CPW feed, then single metallic layer antenna can be configured with 16.5×20nm antenna size to provide better bandwidth

Parameters	IE3D simulation	LM - ANN
Lesser Frequency	5.14	5.144
Upper frequency	6.47	6.48
Centre frequency	5.798	5.8
Bandwidth	1.3	1.35
% Bandwidth	22.98	23.2
VSWR	1.02	1.04
Return loss	-39.2	-38.8
Impedance	49.56	49.68

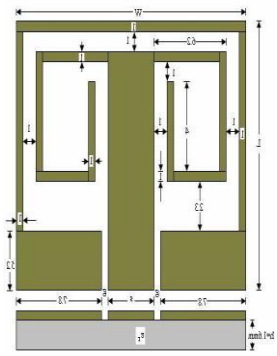


Fig. 4 Comparison between neural model and simulated CPW and Proposed CPW Fed Folded Antenna [16].

Mishra el at. [21] investigated that Circular Patch antenna prototype for experimentation was found to be difficult, therefore ANN is used to develop the parameters. ANN is used because of its learning ability, fault tolerance and non-linearity. The Investigation model comprises of constraints like permittivity, Radius and substrate height and the output is the resonant frequency whereas the radius with resonant frequency, permittivity and substrate height is provided by synthesis model. Conjugate Gradient Back propagation algorithm will be used for investigation and for synthesis model. Fig. 5 shows that the investigation model provide deviation of -.00269 while the synthesis model give deviation of -0.00513 from the measured antenna. Conjugate Gradient ANN based model give good generalization capacity and good arrangement between the network results and the fabricated patch results. Neural model provide good correctness and no complex mathematical functions. ANN model provide robust results when used for more data set and results can be predicted efficiently.

Input Parameters			Target	CG	
a(radius)	H	ε_r	f_r	ANN O/P	Error
0.77	0.235	4.55	5.434885	5.478789	-0.0439
1.04	0.235	4.55	4.090526	4.075794	0.014733
2	0.235	4.55	2.15468	2.154905	-0.00022
2.99	0.235	4.55	1.438828	1.474218	-0.03539
3.975	0.235	4.55	1.078434	1.078762	-0.00033
4.95	0.235	4.55	0.863001	0.814031	0.04897
Average Deviation			2.510059	2.51275	-0.00269

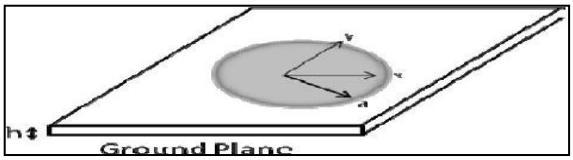


Fig. 5 Circular Microstrip Antenna (CMSA) and the estimate of resonant frequency using Conjugate Gradient ANN [21].

Arora el at. [22] investigated that now a days, in wireless communication systems for both profitable and military applications smaller size multiband antenna are in huge demand. The fractal geometry means fragmented statistical figure that can be divided into groups, each part is a compact size copy of the total. Therefore, the fractal designed antenna are better selected to diminish the antenna dimension, to provide multiband presentation and light weight, low cost and compatibility with incorporated circuitry. Microstrip antennas can work at many bands of interest using fractal geometry with thought-out choice of the schemes and iterations as shown in Fig. 6. The advantages offered by Fractal antennas are light weight, conformability to designed exterior, low cost and combined circuit compatibility. Artificial Neural Networks (ANN) is accomplished with Back propagation method for computing the resonant frequency and gain of antenna. Data set for 100 different values was obtained using IDE3 software at antenna feed positions for unlike repetitions. This information was obtained to train Artificial Neural Network. Trained data set was verified by compelling unidentified input value and then the ANN outcomes are related with IE3D Software. The resulted gain attained by ANN method are in good arrangement with the simulated result.

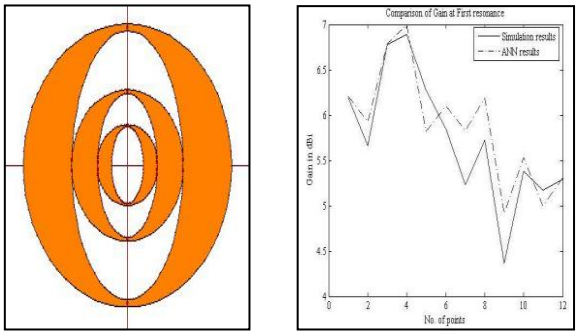


Fig. 6 Proposed Elliptical Fractal Antenna and Comparison of ANN outcomes for gain in initial resonance band with simulated results [20].

Sarmah el at. [23] investigated that the constraints of Loop Antenna for transfer and accept condition for real world communication was predicted using ANN. The expected set of factors are obtained to provide the measurements for loop antenna which comprises of hypothetical calculations. In this paper, to optimize the dimensions of loop antenna in relation to frequency of action at certain fact of period for a loop antenna, single element pair of thickness and radius is measured. The 11 set of wire and loop radius are used for producing the radiation efficiency. Fig. 7 shows the essential set of loop radius and wire radius produced by the SOM for the condition that the efficiency is not only maximizes the value but also within in the required range after the training. The result obtained by SOM convergence is used to estimate the radiation efficiency when reaches the optimal level can be tested using hypothetical considerations. In this, Self-organizing map (SOM) is used to provide the design of loop antenna for application such as conductor thickness and loop radius with electrically driven finite element grid. SOM is used to define the dimensions of loop antenna for establishing the physical design so that the plan can handle the deviations detected in transfer and accept condition.

Loop radius 'a' in meter	Wire radius 'b' in meter
0.0320	0.0010444
0.0335	0.001399
0.0350	0.0017544
0.0365	0.002109
0.0380	0.0024644
0.0395	0.0028194
0.0410	0.003174
0.0425	0.003529
0.0440	0.003884
0.0455	0.004239
0.0470	0.00459

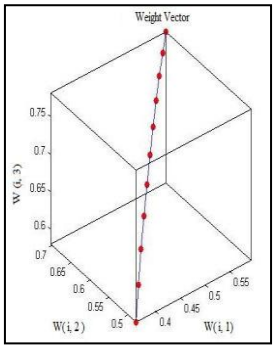


Fig. 7 Improved set produced by SOM and SOM Topology to produce the best likely set values [23].

Bose et al. [24] proposed an Artificial Neural Network model using Hybrid network for the designing of Aperture coupled Microstrip antenna. Aperture coupled Antenna is presented in Fig. 1 which comprises of two substrates parted by a ground plane. A slight aperture is cut to permit coupling from an exposed circuited microstrip feed line to radiating patch. They investigated that the antenna size is forced to be reduced as the device size is shrinking. Due to reduction in size, resonant frequency moves to higher point and Bandwidth is decreasing which makes the designing difficult. The researchers has used ANN model to eliminate the complex mathematical procedures and complex iterations with low error and less time. ACMSA is fabricated with a bandwidth of 4 GHz and determined return loss of 2.46 GHz and outcomes for S11 representation is attained using a hybrid model which is related to the simulated result. BPA displays mean error of about 1.4% and Radial basis function yields 37.8% of mean error but the hybrid network produces the mean error of 0.327% which make it superior in relation to precision and calculation time.

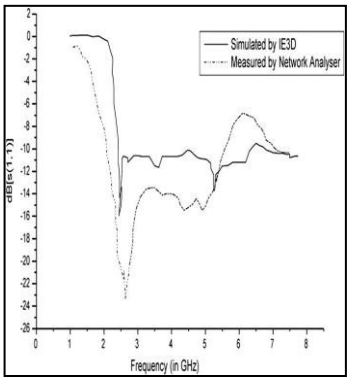


Fig. 8 Aperture coupled microstrip antenna and Measured and simulated results of the designed antenna.

Wang et al. [26] proposed a Neural Network for designing of particular Feed Antenna with Truncated Curves shown in Fig. 9. A four-sided patch with measurement of l×l is imprinted against thickness H dielectric substrate and relative permittivity Ɛr. Single feed configuration is used to provide low cost fabrication, simple structure and a phase shift of 90°. The corners are truncated to produce polarized radiation. Authors have obtained the training data set by mathematical formula of resonant frequency and Q factor. In the proposed work, Levenberg Marquaedt algorithm was used to achieve accurate synthesis, Average relative Error and Minimal error. To validate the model the result attained from ANN algorithm are related with HFSS software simulation result.

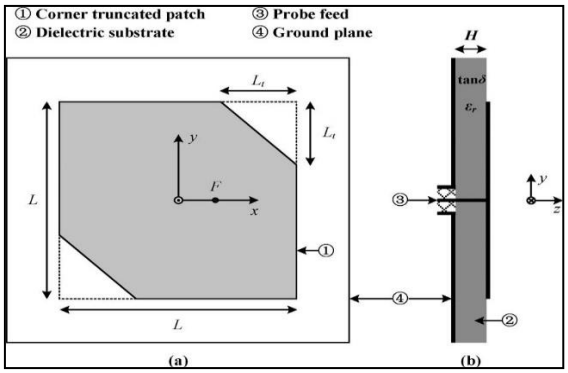


Fig. 9 Geometry of single feed Microstrip antenna with truncated curves showing the Top view and Side view [26].

Bedra al. [27] developed an ANN model to calculate dimensions of antenna for given resonant frequencies, substrate height and permittivity. ANN is designed to analyze patch geometry of circular microstrip antenna and reverse modeling is used to analyze ANN resonant frequency in terms of patch dimensions, permittivity and height of substrate. Gaussian and multiquadratic radial basis activation function is used to develop Feed forward propagation network. The simulation is performed on HFSS software to provide Return loss, VSWR and plot of electric field. The plot of return loss and VSWR is shown in Fig. 10. A high accuracy result of patch radius is obtained by inputting the values of permittivity, height and resonant frequency. The parameters of analysis ANN network is obtained by reversing the input output data of synthesis and the results from synthesized network is examined against target in the analysis network in terms of resonant frequency. The ANN provides accurate results and provide results in less time.

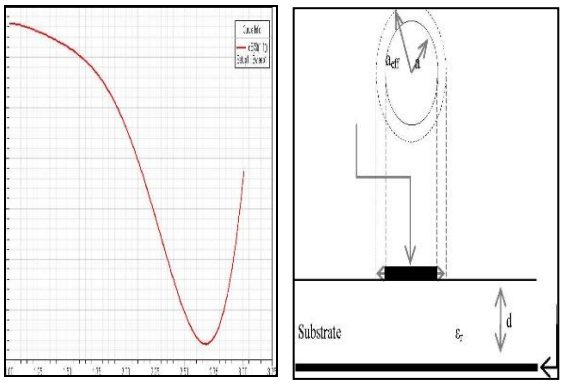


Fig. 10 Plot of return loss and VSWR and geometry of circular microstrip antenna [27].

Robustillo et al. [28] investigated the Reflectarray antenna design with 3 sheets of variable size patch and optimize the patch measurements to recompense three-dimensional phase interruption in the Ku-band. A reflectarray antenna with amplitude of the occurrence field shown in Fig. 11 is obtained by the radiation arrangement of feed horn, thus the phase shift provided by individual elements is adjusted to fulfill the beam determining requirements. To obtain 10% bandwidth, global optimization process was applied. ANN is initiated to produce the amplitude and phase of composite reflection constant. Therefore for this purpose, 6 geometrical parameters (length and width of each patch layer), angle of incidence (varies from 0° to 34°), frequency and elevation is used. Then the electromagnetic calculation is exchanged with trained Artificial Neural Network (ANN) to attain electric field on the radiation pattern. Trained ANN provides low response time in comparison to conventional EM Simulation. ANN licenses the investigation of universal antenna in limited seconds and offer high demand in relation of gain and design shape for Contoured-beam Reflectarray antenna. For flexible results several ANN procedures have been executed such as sheet segmentation for sample calculation and multi-step training.

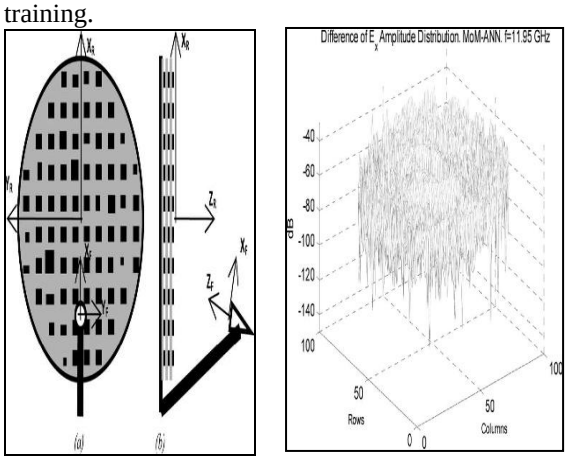


Fig. 11 Sketch of reflect array antenna and electric field calculated from MoM and from ANN [28].

Taimoor et al. [32] presented a Neural Network Based model for calculating the air gap among substrate plane, ground plane and Slot size of the Radiating Patch antenna. The patch of measurements 60×57 mm is impressed on the superior side of substrate, however air-gap of about 5.1mm^2 between the substrate and ground plane is introduced shown in Fig. 12 They investigated that the operation is performed on dual frequency mode which result in low profile and low cost fabrication but the parameters like bandwidth, gain and efficiency is also low. ANN model takes very few seconds in providing the result after training and also provide accurate result. For validation they fabricated a prototype and observed that good combined measured and simulated results are obtained. A good conformism is attained if the replicated dual resonance is connected to the measuring value.

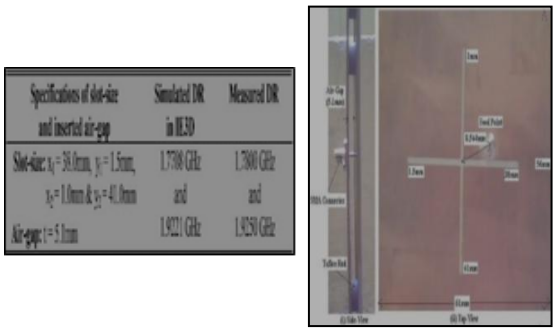
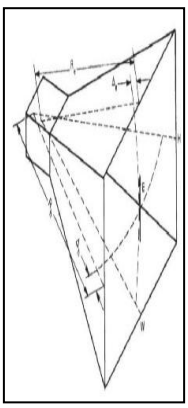


Fig. 12 Fabricated antenna and comparison between stimulated and measured DR.

Modi el at. [33] investigated that the Optimization of pyramidal horn antenna with L band is carried out by means of artificial neural network (ANN). Horn antenna are used because it have no resonant component and can function at a wide range of frequencies. FBF Artificial Neural network was designed to calculate the best dimensions of horn antenna for preferred gain and frequency. Data for training is obtained by half wave simulator and then it is tested for various combination of gain and frequency. By varying the gain and frequency, length of horn antenna, flared end width and height can be obtained by ANN through proper training and horn antenna was designed for the same values by the full wave simulator. From Fig. 13 it is clear that the percentage error in preferred gain is less than 1.3% for all measured arrangements over the L-band. The width and height also provide the error less than 1.4% for the desired range of frequency and gain. Thus, ANN is used to provide output in less time and with high accuracy for the optimum gain pyramidal horn antenna



Desired Frequency	Desired gain	Achieved gain using ANN	Percentage (%) error in gain
1.196	16.039	16.031	0.0467
1.253	16.284	16.215	0.4239
1.368	15.700	15.894	1.2364
1.541	17.627	17.517	0.6217
1.713	17.835	18.019	1.0296
1.656	16.246	16.254	0.0441
1.598	14.322	14.350	0.1932

Fig. 13 Horn antenna geometry and Comparison among preferred gain and attained gain [33].

Manh et al. [34] investigated the optimization of electromagnetic problems in Microstrip antenna because of its low cost and low profile. The twin rectangular ring arrangement is shown in Fig. 14 which produces more units of freedom to inventers then at the same period produces more complication. Further, to diminish the computational determinations for adjusting electromagnetic field in antenna, ANN has been used. Proximity coupled-feed microstrip antenna has been optimized by full-wave spectral analysis but this antenna provides more complexity. To reduce the calculation effort, accurate and rapid ANN model with Gradient Descent training method is used. They proposed an LM approach which manages both the non-liners difficulties and ANN magnitude and its characteristics. ANN design saves a critical amount of computation time and the results obtain by ANN are authenticated by Full wave investigation to exam the accuracy. Antenna radiation observed as a loss technique and return loss was composite therefore, for bandwidth optimization difficulty real and imaginary parts are combined to generate Amplitude. The graph shown in Fig. 14 validates that all future approaches have a good competition with target data. But, LM approach provide a better performance as the complete modification among the targeted information and ANN outcome was only 0.0005.

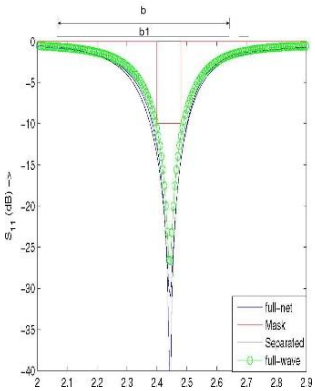


Fig. 14 Test object antenna view and ANN optimization and full-wave analysis validation [34].

Reddy et al. [38] Proposed a novel Photonic band gap based PIFA structure operating in Digital Communication system band shown in Fig. 15. They investigated the reduction in antenna size by using Meta material structure. The aim of the research is optimization of PBG PIFA system by varying feed point, change in radiation patch dimension. Hence, soft computing is used to provide quick response, accuracy and take less time. Soft computing is chosen to provide improved impedance bandwidth when associated with predictable PIFA. From Fig. 15, it is detected that predictable Planar inverted F antenna resonates at 1.8GHz and bandwidth is 25.39% but the enhanced antenna displays the impedance bandwidth of about 39.9% and gain of 6.03dB, therefore it can be realistic to WLAN 2.4 and Bluetooth wireless technology.

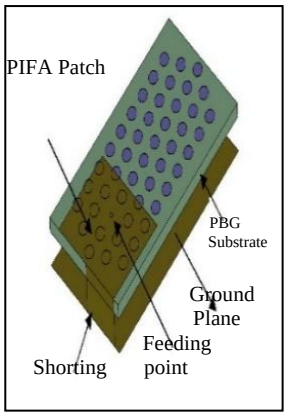


Fig. 15 PBG based PIFA and performance parameters of PIFA [38].

III. INFERENCES DRAWN OUT OF LITERATURE REVIEW

The main advantage of using the Soft computing technique is that it increases the robustness and antenna performance. Results obtained from Soft computing technique and the HFSS simulation take less computation time and accuracy is provided by soft computing technique. Microstrip antenna is used because of small size, low profile and operation at different frequencies. Optimization is used to design an antenna of small size, provide quick response, performance constraints and accuracy.

ANN is used because of their ability to estimate complex relationship between input and output data and flexibility to learn and generalize features [17]-[20]. It requires high processing time for the large network. The performance of Rectangular microstrip antenna can be improved by predicting the slot size and air gap among ground plane and substrate plate for achieving resonant frequency (1.5-3GHz), Gain (6.2-9.6dBi), radiation efficiency (85%-100%). It has concluded that neural approach require less time for achieving the required result [25].

Back propagation algorithm is preferred in antenna in terms of prediction accuracy, convergence speed and less training time. It also reduces the mean square error and relative mean error. Levenbarg-Marquardt is used for non-linear optimization to give minimum root mean square error and it does not guarantee the generalization ability of trained network, especially when trained data set is smaller than the number of parameters. Resonant frequency of Rectangular Microstrip patch antenna is obtained using LM Algorithm. This algorithm shows better performance to obtain resonant frequency and take less computation less.

Antennas devise the benefit that radiation arrangement can be regenerated by altering the feeding circulation from their base station. Many compensation methods are used and to use these techniques it is essential to know the quantity and position of the faulty features in the array which would provide increase in volume, weight and cost. Genetic algorithm avoids local convergence and obtains near optimum result from a very huge and complex space. GA may not evolve better solution due to crossover operation, large sample and there is no validation check for accuracy. GA procedure needs equally the unique radiation arrangement and the measurement from the station of compromised radiation design. Artificial neural network provide the advantage to entirely avoid the iterative procedure after attainment of an accurately trained network [29]-[31].

For a precise, practical and fast neural network classification, numerous methods have been executed, like layer separation for computing the sample space, manipulation of regularities and multistep training. The impedance matching in antenna at the feed point is essential for the competent procedure of antenna. But to accomplish a simple microstrip antennas is not easy [35]-[37]. This difficulty is more compound in instance of fractal antenna because of tough design of dissimilar iterations. In order, to solve this problem an ANN model is used in which feed position and amount of iterations are reserved as inputs and it provide various parameters as outputs.

Parameters	Value
Frequency of operation	1.824GHz
Gain	-6.03dB
Directivity	5.98dBi
Impedance Bandwidth	39.9%

IV. CONCLUSION

Antenna parameters like bandwidth is need to be improved to expand the performance of the antenna. The design optimization involve the position of the feed, dimension of the radiating patch and the height of the shorting plate, this is a time consuming task. Therefore, Soft computing provide quick response and accuracy to optimize the bandwidth and improve the parameters like return loss, gain etc.

Back propagation algorithm can be preferred to optimize bandwidth, improve the gain and return loss and various other parameters through simple implementation. The complex mathematical formula when applied to any network can reduce mean square error (MSE) and relative mean square error (RMSE).

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