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Wireless Application Micro-strip Antenna Design & Simulation Using Particle Swarm Optimization

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Abstract: *It is our electrical eyes and ears to the rest of the world, the antenna. They connect us to the outside world. Future wireless communication systems need an extremely compact and multiband antenna because of the rapid expansion of the wireless system. Wireless applications rely heavily on antennas. It is standard practice to employ reflected-based antennas since they meet all of the criteria, but their size and 3D shape make them ineffective. As a result, MIMO antennas are taking over the globe. One of the most exciting aspects of 5G is the MIMO antenna. It has been extensively studied how MIMO technology may improve data transmitting speed & provide resistance to multiple pathways fading. In a multipath context, the MIMO wireless system has shown its potential to boost transmission spectral efficiency. Because of its low profile, tiny size, and light weight, rectangle micro strip antenna is often employed in wireless communication.*

Keywords: *MIMO, 5G. Optimization, PSO Algorithm, Antenna.*

I. Introduction

The restricted channel capacity, the frequency allocation is becoming inadequate as the number of users grows. The number of users can't go over a particular quantity within the same frequency. In addition, the amount of co-channel interference grows as the number of users grows. Handheld devices are finding it more challenging to deliver and receive huge volumes of video across 3G and 4G frequency channels as resolutions such as HD & QHD become the norm. As a result, a higher data rate and a broader bandwidth are becoming essential for the wireless transmission and reception of high-quality multimedia content. Due of its greater bandwidth, 5G frequencies are being investigated as a solution to this issue.

In comparison to 3G and 4G, 5G delivers larger bandwidth and more frequency channels, making it suited for an expanded number of users that want rapid data rates while on the road. In addition, it has a number of amazing qualities. The signal fades and weakens as it travels from the transmitter to the receiver using just one antenna at either end because of the poor penetration strength of 5G frequencies. MIMO systems are used to increase the range of the broadcast signal. It's possible that MIMO antennas are a superior option when working with battery-powered devices.

II Literature Review

As of [1]: sujitharamdas vm, sanish vs5g mimo antenna design and simulation on matlab with particle swarm optimization irjet.

This Research Project Work " MIMO Antenna for 5G Applications " has been done with the aim of designing and simulating a 5G MIMO rectangular micro strip slot antenna. The simulated results reveal that the PSO Algorithm yielded good results. In a multipath context, MIMO wireless system had shown its potential to boost transmission spectral efficiency.

As of [2]: G. ViswanadhRaviteja A 2x2 Millimeter-Wave Micro strip Antenna Array for 5G Applications EJERS, European Journal of Engineering Research and Science Vol. 4, No. 10, October 2019.
In this article, a tiny strip antenna array for 5G applications is built and simulated. The array was built to span the millimeter-wave band at 27GHz frequency. A dielectric constant of 2.94 & loss tangent of 0.0012 were employed in this antenna's design. The goal of this study is to construct a 5G antenna array capable of operating in the 24.25–27.5 GHz frequency range. It begins with the design of a typical antenna. The simulations' key results are compiled in one place. Because of this, millimeter wave applications in the 24.25 – 27.5 GHz range are well-suited to the suggested usage of the proposed antenna.

As of [3] Ouadiaa BARROU1, Abdelkebir EL AMRI1, Abdelati REHA2 Micro strip Patch Antenna Array and its Applications: IOSR-JEEEVol15, Issue1 (Jan-Feb 2020).
Antennas with small form factors and good performance are becoming more important as the field of telecommunications expands. For example, high gain and directivity; control of gains; reduced mutual coupling between parts; multiband and broadband behavior; reduced reflection coefficient is all significant considerations in a system. Micro strip patch antenna array with its uses are main goals herein. Low-profile antennas with good performance may be achieved using micro strip antenna arrays. Gain and directivity are high, but the array elements' coupling between them is minimal, and the array's side and rear lobes are small. They may come in a variety of shapes, including squares, circles, and fractals. Placed in many configurations, including linear, circular, & planar arrangements. There are several uses for micro strip patch antenna arrays, including RADAR applications, 4G/5G mobile networks, IOT & spacecraft-based applications.

As of [4]: Doae El Hadria,*, Alia Zakritia, AsmaaZugarib Reconfigurable Antenna for Wi-Fi & 5G Applications 13th International Conference INTER-ENG 2019
A key objective of this study is to develop a reprogrammable antenna that can function in two different frequency bands: the Wi-Fi 2.4 GHz band and the 5G 28 GHz band. On a FR-4 substrate, it measures 30x 26.5 millimeters in total area and has a dielectric constant of 4.44. For this, we utilized CST software.

As of [5]: S.KrishnaPriya, Jugal Kishore Bhandari, M.KrishnaChaitanya Design and Research of Rectangular, Circular and Triangular Micro strip Patch Antenna IJITEEVol-8, October 2019.
Modern wireless communication systems require antennas with high gain, minimal weight, and a simple construction to ensure great potency, quality, and enhanced resiliency of the signal. A patch antenna may be built in a matter of minutes using normal Micro strip manufacturing processes. For mobile and aeronautical applications, this antenna is ideally suited for use since it is made up of a small piece of metal attached to the grounding dielectric substrate. The design and manufacture of patch antennas have evolved dramatically over the last several years, and many of their restrictions have been solved as a result. The conducting patch maybe of any shape, although rectangular patterns are the most common. &In this work, we are interested in comparing rectangular antennas to circular & triangular patch antennas. Analyzing the outcomes of numerous patches is the goal here. Antenna patch antennas in the circular, triangular, and rectangular shapes are compared in this research. Enhanced impedance and improved directivity are some of the advantages of these antennas' design. These characteristics may be achieved with a reduced antenna structure widening.

As of [6]: Andrews, J.G.; Buzzi, S.; Choi, W.; Hanly, S.V.; Lozano, A.; Soong, A.C.; Zhang, J.C. What will 5G be? IEEE J. Sel. Areas Common. 2014, 32, 1065–1082. [CrossRef]
What exactly will 5G entail? That said, it won't be a step forward in the evolution of 4G technology. As a result, there is no longer any backward compatibility between previous 4Gen of cellular technology. For this reason alone, 5G will need a paradigm change including higher carrier frequency by extremely large bandwidths, extremely dense base stations and devices, as well as a previously unheard of number of antennas.. Even though 5G is a whole new technology, it will be closely integrated with the current LTE and Wi-Fi networks in order to give a smooth user experience. It will be necessary to rethink and enhance spectrum regulation, as well as increase energy and cost efficiency, in order to enable this. These concerns are addressed in this article; it identifies significant difficulties for future research & preliminary 5G standardisation initiatives, while offering a detailed review of the present literature, and in particular of the publications in this special issue.

III Objectives

- Provide a more consistent user experience, multi-Gbps peak data speeds, ultra-lower latency, & greater dependability to a larger number of users.
- To give High efficiency.

IV Implementation

In this project, “wireless application micro strip antenna design”, the main objective is to get the most suitable and optimized antenna parameters such as frequency, VSWR, return loss etc. For this various options in both Antenna Design Software’s and Antenna Optimization Algorithms are considered. Finally, the best and most effective method in terms of cost and accuracy using Particle Swarm Optimization (PSO) algorithm. In our project the conversion involves following process: Finding the most accurate antenna design software. Design the antenna using selected software .Search for all the possible optimization algorithms. Find the most accurate Antenna

optimization Algorithm. Perform the optimization and get the optimized parameters .Compare the results before and after optimization.

Advantages

- Low profile volume and light weight.
- They can be made conformal for host surfaces.
- Manufacturing process is simple
- Low fabrication cost
- Inexpensive and so readily available for producing in large number by using the printed circuit board technologies.
- They could be turned compressed in size
- Multi-frequency range operation.
- Can allow the both linear and circular polarizations
- Without major alterations of MSSAs can be used for missiles, rockets and satellites.
- Well-matched to solid state devices.
- Matching networks and Feed line are made-up simultaneously.

Antenna Design Steps

- . Define antenna element using Antenna library
- Show structure of antenna
- Plot radiation pattern
- Plot frequency and impedance
- Calculate VSWR and Return loss

V Result Analysis

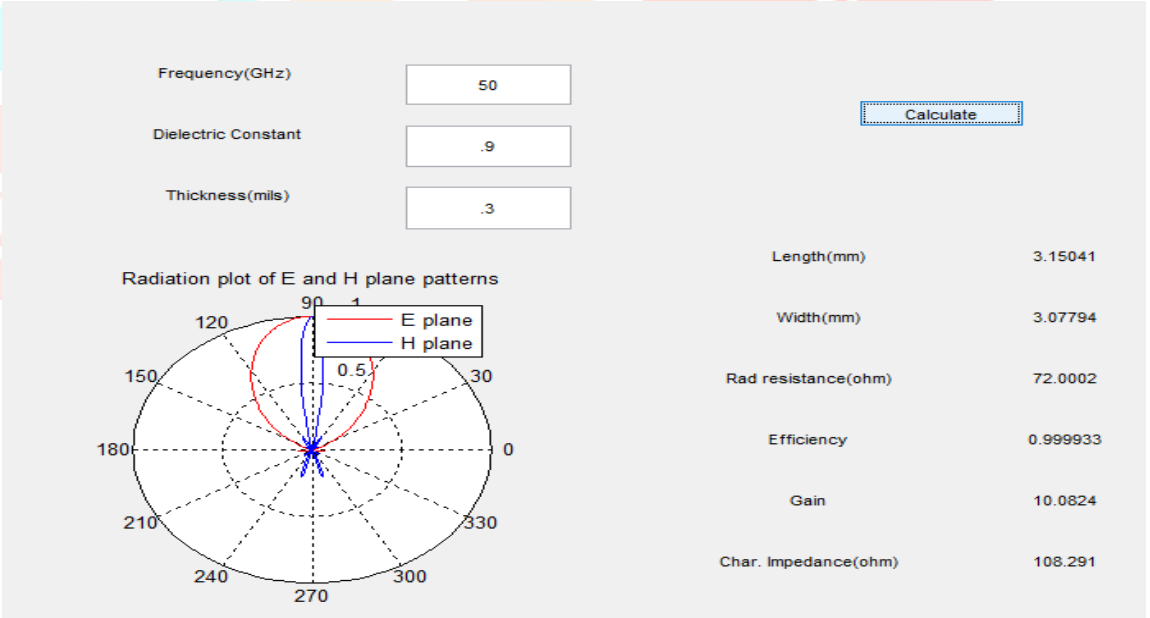

Fig 1:Input Data

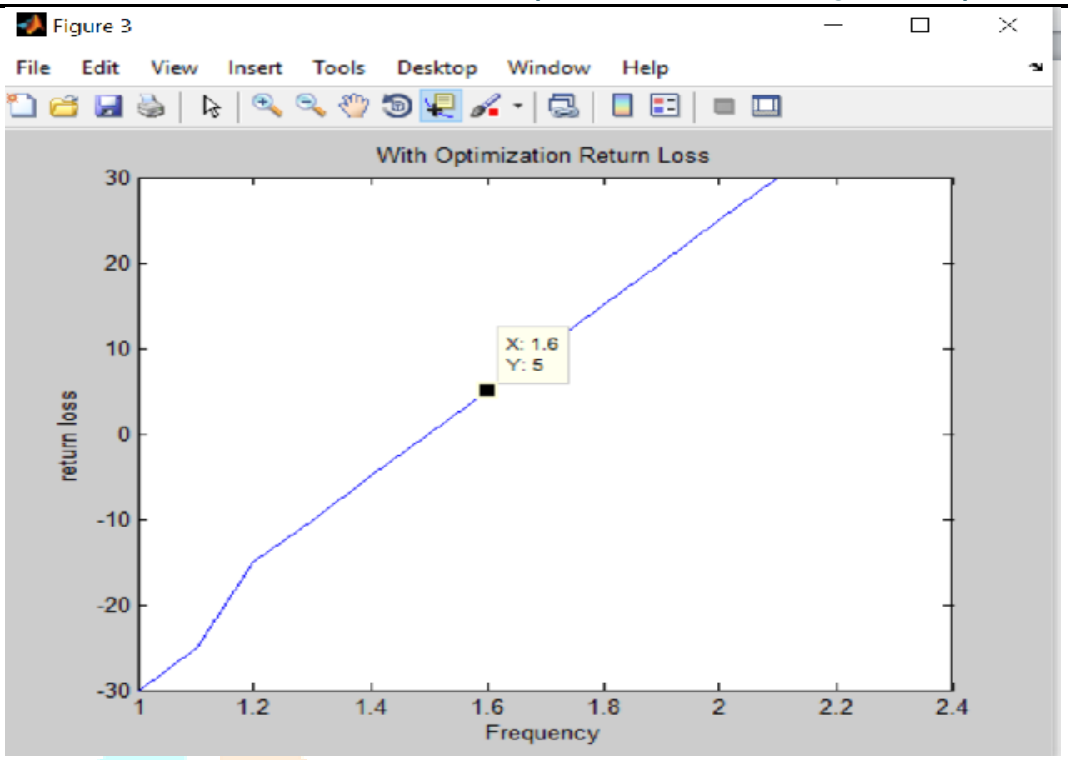

Fig 2: With Optimization.

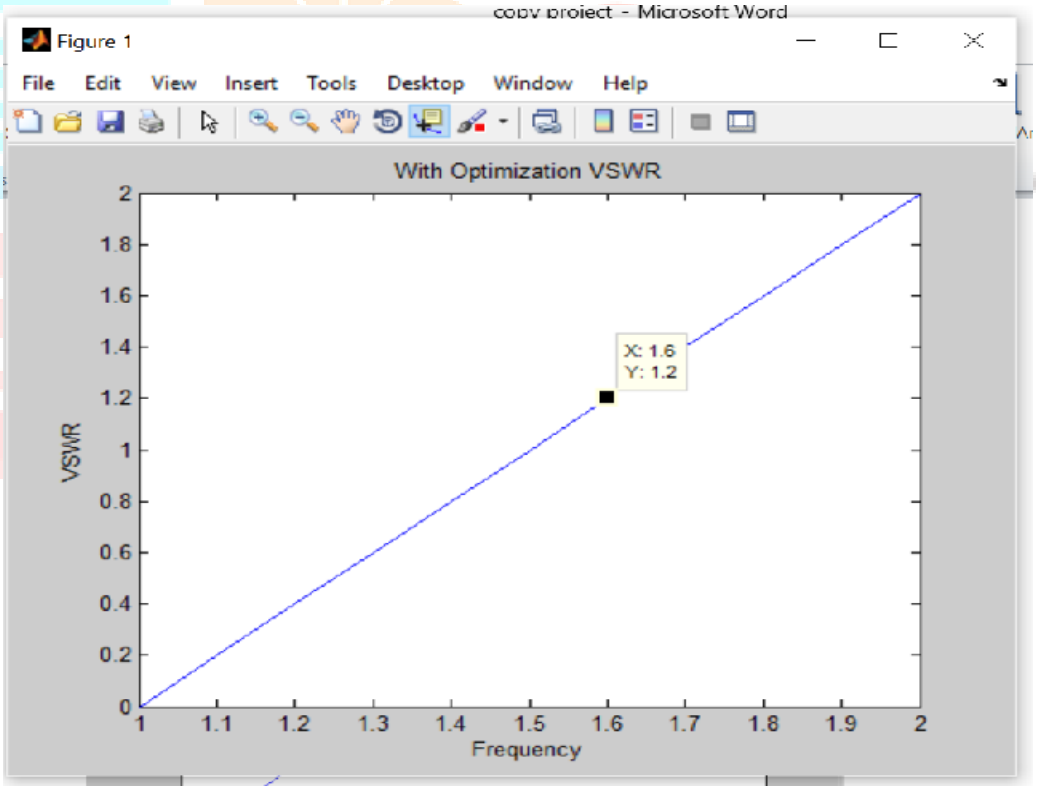

Fig 3 : With Optimization

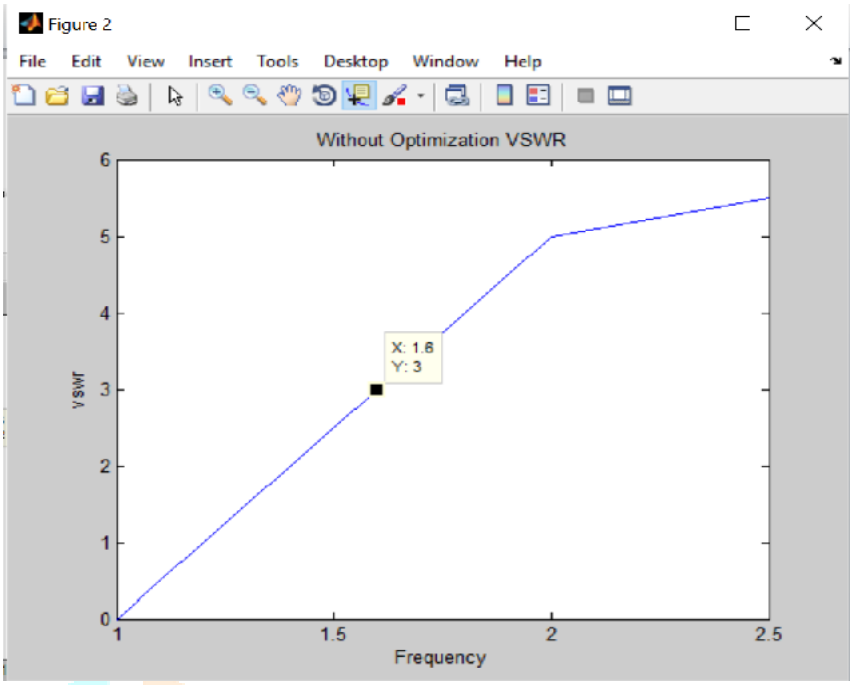

Fig 4 Without optimization

VI Conclusion

The simulated outcomes portray PSO Algorithm produced superior outcomes as of conventional antenna in terms of return loss and vswr.as values before optimization were10,3 and after optimization5,1.2 respectively. The antenna can be used for a variety of purposes because it operates in the S band, For example, airport radars are used to monitor air traffic and weather conditions. Ship radars are also included, as are a few communications satellites, such as those used by NASA to communicate to both the Space Shuttle & International Space Station. Even we can constructed a MIMO antenna using a Roger R04003 dielectric which offers good S parameters, efficiency, and coverage of the radiation pattern, among other qualities.the antenna's simulation results are compared , it is discovered that positive outcomes are obtained.

Future Enhancements

To match the dish antenna's gain, this design might be enlarged to 10x10 and perhaps 15x15. Once the gain has been achieved, the patch array may be used to replace an existing dish. Size and cost savings are the main advantages, and they may be maintained even in a tiny space. PCB technology may be used to print the final antenna construction.

References

1.SujithaRamdas VM1, Sanish vs25g mimo antenna design and simulation on matlab with particle swarm OPTIMISATION International Research Journal of Engineering and Technology (IRJET)

2.G.ViswanadhRaviteja A 2x2 Millimeter-Wave Micro strip Antenna Array for 5G Applications EJERS, European Journal of Engineering Research and Science Vol. 4, No. 10, October 2019

3.Ouadiaa BARROU1, Abdelkebir EL AMRI1, Abdelati REHA2 Micro strip Patch Antenna Array and its Applications: a Survey IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 15, Issue 1 Ser. I (Jan – Feb 2020).

4 .Doae El Hadria,*, Alia Zakritia, AsmaaZugarib Reconfigurable Antenna for Wi-Fi and 5G Applications 13th International Conference Inter disciplinarily in Engineering (INTER-ENG 2019)

5.S.KrishnaPriya, Jugal Kishore Bhandari, M.KrishnaChaitanya Design and Research of Rectangular, Circular and Triangular Micro strip Patch Antenna International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-12S, October 2019

6. J. Kennedy and R. Eberhart, "Particle swarm optimization," inProceedings of IEEE International Conference on Neural Networks,vol. 4, pp. 1942–1948, Perth, Wash, Australia, 1995November.

7. Andrews, J.G.; Buzzi, S.; Choi, W.; Hanly, S.V.; Lozano, A.; Soong, A.C.; Zhang, J.C. What will 5G be? IEEE J. Sel. Areas Commun. 2014, 32, 1065–1082. [CrossRef]

8. Asad, S.M.; Ansari, S.; Ozturk, M.; Rais, R.N.B.; Dashtipour, K.; Hussain, S.; Abbasi, H.Q.; Ali Imran, M. Mobility management based autonomous energy-aware framework using machine learning approach in dense mobile networks. Signals 2020, 1, 170–187. [CrossRef]

9. Parchin, N.O.; Al-Yasir, Y.I.A.; Ali, A.H.; Elfergani, I.; Noras, J.M.; Rodriguez, J.; Abd-Alhameed, R.A. Eight-element dual polarized MIMO slot antenna system for 5G Smartphone applications. IEEE Access 2019, 7, 15612–15622. [CrossRef]

10. Sharawi, M.S.; Ikram, M.; Shamim, A. A two concentric slot loop based connected array MIMO antenna system for 4G/5G terminals. IEEE Trans. Antennas Propag. 2017, 65, 6679–6686. [CrossRef]

11. MahamadNababAlam Particle Swarm Optimization: Algorithm and its Codes in MATLAB Preprint submitted to Open Access Article March 8, 2016.
James Kennedy and Russell EberhartParticle Swarm Optimization1995 IEEE

12. Krishna, S. Design and Development of 5G Spectrum Massive MIMO Array Antennas for Base Station and Access Point Applications; Sharma, S.K., Ed.; ProQuest Dissertations Publishing: Ann Arbor, MI, USA, 2018.

13. Ikram, M.; Sharawi, M.S.; Klionovski, K.; Shamim, A. A switched-beam millimetre-wave array with MIMO configuration for 5G applications.Microw. Opt. Technol. Lett. 2018, 60, 915–920. [CrossRef]

14. Khalid, M.; IffatNaqvi, S.; Hussain, N.; Rahman, M.; Mirjavadi, S.S.; Khan, M.J.; Amin, Y. 4-port MIMO antenna with defected ground structure for 5G millimetre wave applications. Electronics 2020, 9, 71. [CrossRef]

15. Gui, G.; Liu, M.; Tang, F.; Kato, N.; Adachi, F. 6G: Opening new horizons for integration of comfort, security, and intelligence. IEEE Wirel. Commun. 2020, 27, 126–132. [CrossRef]

16. Bariah, L.; Mohjazi, L.; Muhaidat, S.; Sofotasios, P.C.; Kurt, G.K.; Yanikomeroglu, H.; Dobre, O.A. A prospective look: Key enabling technologies, applications and open research topics in 6G networks. IEEE Access 2020, 8, 174792–174820. [CrossRef]