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A Review Paper on Design of Graphene Based DRA

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ABSTRACT: In paper we have a look at a Dielectric Resonator Antenna (DRA) with a Graphene coating. In last few years, DRA act as a major function with respect to wireless provider necessities. Many structures of DRA have been applied to certain areas as it offers various benefits such as no inherent conductor loss, simpler coupling and the advantage of being lightweight. In this project we will be dealing with a conical shaped DRA with a coating of graphene and a micro strip technique to gain its enhanced features in different applications of ultra-wide band.

KEYWORDS: Dielectric Resonator Antenna (DRA), Graphene, Microstrip feeding, Applications.

INTRODUCTION

Antenna is always a powerful and preferred part of wireless communication. Over a long time, the design of DRA has caught many researches interest due to its many properties like low loss and easy to excite. Moreover, the usage of the dielectric of the DRA, length and bandwidth is effortlessly manipulated to attain high benefit and high radiation performance. A DRA is a type antenna that acts on the whole used at microwave-frequencies and above. It includes, block of ceramic-fabric that can be of various shapes, the steel surface that has a resonator and also a ground plane [1]. We have seen in the previous research that the DRA can efficiently have unique mechanism of excitation. Approximate, computation was done on the resonate frequencies by the model of magnetic-wall [2].

Graphene contains a single layer of carbon atoms, and its structure is in the form of honeycomb lattice. It has a very unique 2D structure and basically, the horizontal dimension can be extended whereas thickness remains in atomic scale [3-6]. When we put this material in a 3d structure, it starts exhibiting a very high specific surface area and a low density. Also, graphene has many electrical powers - one of them being its good carrier mobility. Its band structure is also good enough for it to be used in radio frequency circuits [3]. The reason we chose graphene for our project was because graphene in itself has a very unique structure wherein the movement of electrons happen with less resistance. This makes it a better suitable option than metal which can become lossy at high frequencies. Q factor depends on modes of excitation and constant of a dielectric. The element increases and as a result there is decreases in bandwidth as soon as there is an increase in the constant of dielectric. Because of this the DR's of surprisingly low dielectric constant are almost continually utilized in the applications of antenna [4]. Microstrip is a patch made of metal which is put on a dielectric substrate that is placed on a plane. It is easily miniaturized and incorporated with microwave devices making it a one of the major choices of transmission line [7-9].

Microstrip antenna commonly means the fabrication of antenna by use of photolithographic strategies. It was invented by "Robert E Munson". After, the invention of IC's microstrip came into use (as shown in Figure 1).

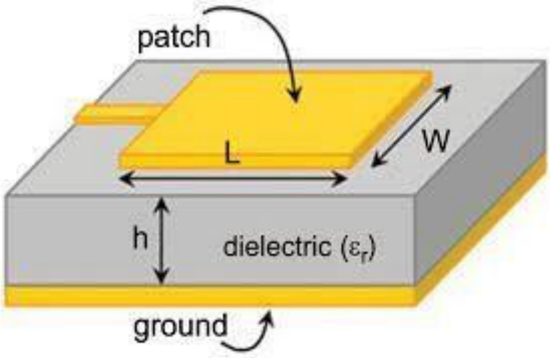
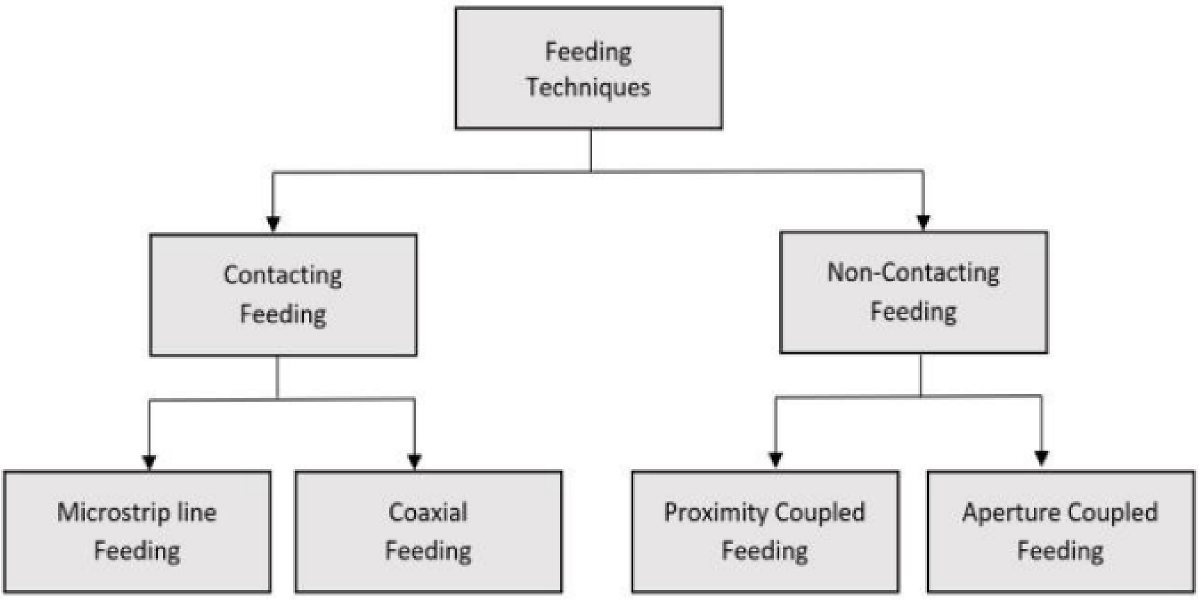


Figure 1: A Typical Patch Antenna

FEEDING TECHNIQUES

Feeding strategies are of two types,

1. Contacting
2. Non-contacting.



(A) Contacting Feeding

1. Coaxial Feeding

An internal conductor is a part of the connector of the coaxial that goes throughout the dielectric and is put on a patch through soldering [10]. The conductor that is on the outer side is placed on ground. Coaxial feeding is easy to match, fabricate, and feature low spurious radiation because of which efficiency becomes better. Figure 2 illustrates coaxial feeding technique used for supplying power to the circuit.

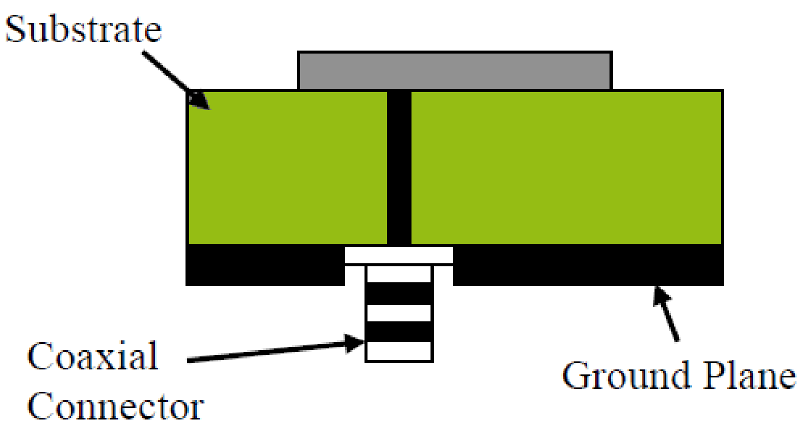


Figure 2: Coaxial Probe Feed

2. Microstrip Feeding

It is a feeding approach, wherein the microstrip patch is at once connected with the accomplishing microstrip feed line. It is easy to fabricate and model [11]. To conquer the problem of varying impedance we notch and do feeding to reduce the mirrored image losses (Figure 3).

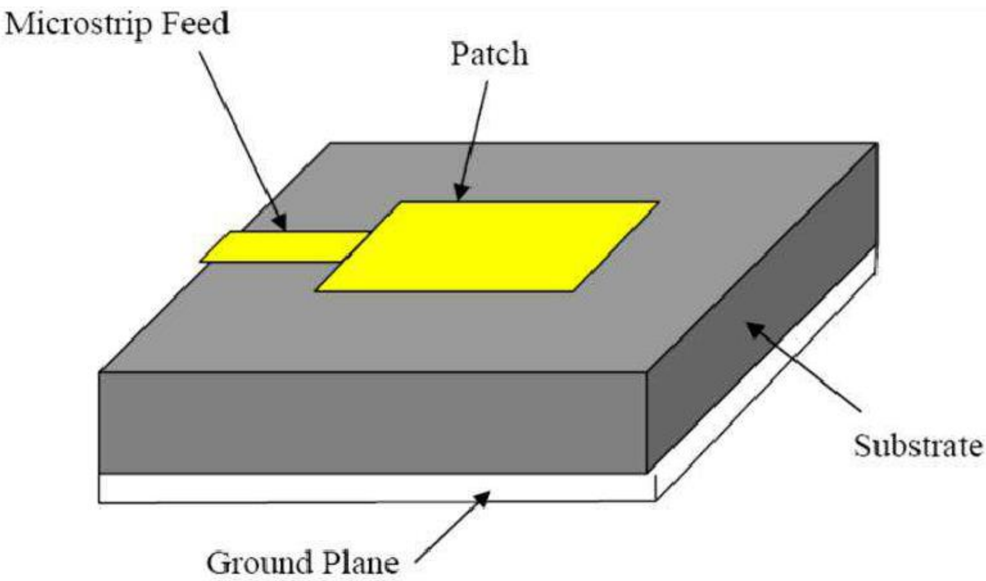


Figure 3: Microstrip Line Feed

(B) Non-Contacting Feeding

1. Aperture Feeding

In this sort of feeding there are substrates, which differ from everyone else and are divided via a plane(ground) and the patch as well as feedline are coupled (by slot) within the plane (ground). It is simple to model and has low spurious radiation (as shown in Figure 4).

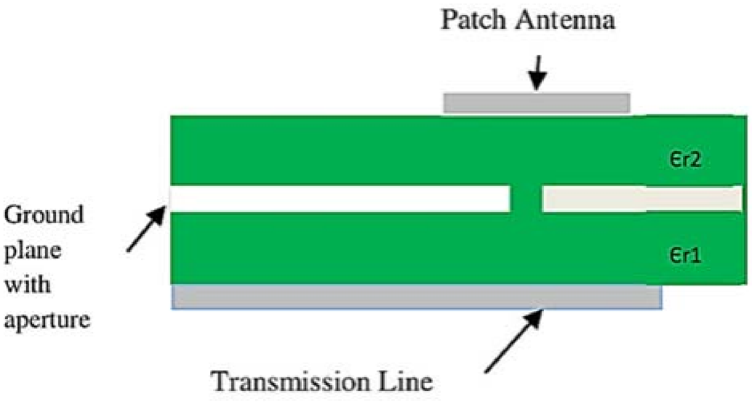


Figure 4: Aperture Coupled Feed

2. Proximity Feeding

In this feeding approach dielectric substrates are used. The micro-strip patch is above the dielectric substrate and the feedline is there among substrates. It offers maximum bandwidth and avoids spurious radiation because of which performance is good [12]. The proximity coupled feed is illustrated in Figure 5.

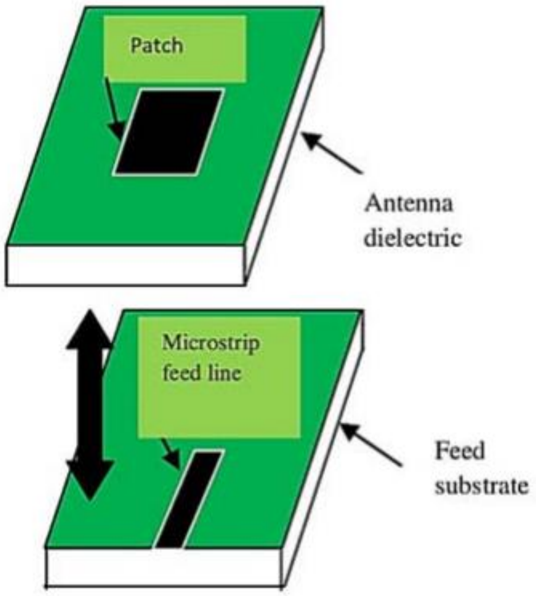


Figure 5: Proximity coupled Feed

PARAMETERS OF ANTENNA

Parameters like VSWR of antenna, Return Loss, Gain of Antenna, Directivity of antenna, Efficiency of antenna and Bandwidth are studied.

(a) Gain of Antenna: The ratio of intensity that we get in a particular direction to the intensity of radiation which we get if the accepted isotopically radiated.

$$G = \frac{4\pi . U(\theta,\emptyset)}{P_{in}}$$

(b) Efficiency of Antenna: When we take the ratio of the full power that is antenna radiated to the given (input) power of the same antenna, it is said to be the efficiency of antenna.

$$e_o = e_r e_c e_d$$

(c) VSWR: It is defined as maximum power upon maximum voltage.

$$\text{VSWR}=\frac{V_{max}}{V_{min}}$$

(d) Radiation Pattern: A illustration of radiation parameter of antenna.

(e) Return Loss: The difference that we get between the forward and reflected power (dB) is the return loss of an antenna.

$$\text{loss} = 20log_{10}\left(\frac{VSWR+1}{VSWR-1}\right)$$

APPLICATIONS

1. For detecting cancerous cell in the human body
2. UV tracking patch
3. For 5G applications
4. Gas detector and air sniffers
5. Cryo-cooler compressor for 5G

CONCLUSION

This paper provides the evaluate on different execution done within the subject of dielectric resonator antenna. After cautiously reading these research papers and one-of-a-kind experimentations finished on DRA, we are able to see that through deciding on proper strategies, editing feed geometry structure of DRA, we can easily increase the bandwidth. The change in the different antenna parameters which have an effect on the area of working and antenna operation had been analyzed. With every new research there was an attempt to make a progress in this field. While reading these, we saw that a DRA with a metal coating faces many disadvantages which we believe can be eradicated by coating it with graphene. There seems to be a need for nano-antennas needed for upcoming technology and graphene is the best option for that.

REFERENCES

[1] K. W. Leung, K. M. Luk, and K. Y. A. Lai, "Input impedance of hemispherical dielectric resonator antenna," Electron.Lett., vol. 27, pp. 2259–2260, 1991.

[2] A. A. Kishk, G. Zhou, and A. W. Glisson, "Analysis of dielectric resonator antennas with emphasis on hemispherical structures," IEEE Antennas and Propagation Magine, vol. 36, pp. 20–31, Apr. 1994

[3] G. P. Junker, A. A. Kishk, A. W. Glisson, and D. Kajfez, "Effect of an air gap on a cylindrical dielectric resonator antenna operating in the TM01 mode", Electron. Lett., vol. 30, no. 2, pp. 97–98, 1994.

[4] S. M. Shum and K. M. Luk "Stacked annular ring dielectric resonator antenna excited by axi-symmetric coaxial probe", IEEE Transactions on Antennas and Propagation, vol. 43, no. 8, pp. 1995.

[5] A. A. Kishk, Y. Yin, and A. W. Glisson "Conical dielectric resonator antennas for wide-band application", IEEE Transactions on Antennas and Propagation, vol. 50, no. 4, pp. 469-474, APRIL 2002.

[6] P. V. Vijumon, S. K. Menon, M. N. Suma, B. Lethakumari, M. T. Sebastian and P. Mohanan, “T-strip-fed high- permittivity rectangular dielectric resonator antenna for broadband applications”, Microw. Opt.Technol. Lett., vol. 47, no. 3, pp. 226–228, Nov. 2005.

[7] A. A. Kishk, R. Chair, and K. F. Lee, “Broadband dielectric resonator antennas excited by L-shaped probe,” IEEE Transactions on Antennas and Propagation, vol. 54, no. 8, pp. 2182–2189, Aug. 2006

[8] T. A. Denidni and Z. Weng” Rectangular dielectric resonator antenna for Ultra-wideband applications” Electronics Letters, vol. 45, no. 24, 2009

[9] A. Al-Zoubi and A. Kishk, “Wide band strip-fed rectangular dielectric resonator antenna”, In Proc. EUCAP’09, Berlin, Germany, pp. 2379–2382, Mar. 23–27, 2009.

[10] K. S. Ryu, and A. A. Kishk, “Ultra-wideband dielectric resonator antenna with broadside patterns mounted on a vertical ground plane edge”, IEEE Transactions on Antennas and Propagation, vol. 58, no. 4, 2010

[11] Gaurav Varshney, Dr. Rajveer Singh Yaduvanshi, Pushkar Praveen “Conical shaped dielectric resonator antenna for ultra-wide band applications” International Conference on Computing, Communication and Automation (ICCCA2015).

[12] Prof. Kaushik Vipul., Dr. Jagruti R. Panchal. “Dielectric Resonator Antenna and its Design Parameters A Review”, International Research Journal of Advanced Engineering and Science, vol.2, no.4, PP. 123-133 Nov (2017).