

Design Helix Antenna by using HFSS

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ABSTRACT

the aim of this paper is to providing actually a current of implicit wireless displacement sensor. The sensor consist of outside helix antenna and an inside aluminum oxide strip (AOS) material. Agreement with the perturbation theory, which there is an imprecise linear relation ship between the transfer of AOS material in the hollow of the helix antenna & resonant frequency of the last. Owing to the configuration of the sensor. In this paper, at first designed the configuration by using MATLAB software program just only the helix antenna, then adding the AOS material strip to the helix antenna. Second step is to study the numerical analysis and mythology measurable factor forming, the both last are conveyed through high frequency structure simulator (HFSS) of the helix antenna without the material AOS, at last step we adding the AOS to the helix antenna. Then design areal helix antenna by using copper material. The evaluation result achieved that the sensor of the determined range has good linearity and sensitivity.

1. Introduction

There are many moving sensors have been extensively employed in structural monitoring (SM), precision optical measurement (POM) and industrial control(IC)[1] and many other application ...etc..., and have been an important studied by private scholar and imported scholar[2].

In this time, the extensively used moving sensor in the field of structural distortion guardian, however, the widely used moving sensor, for example the pulling line of moving sensor adding the pulling bar moving sensor[3]. These standard method have common of advantages at first its resolution high, and good stability ,at last low calculation loss, and evaluation accuracy

that gratify the evaluation requirements of the structural monitoring industry[4]. In order to over come the short coming of usual moving sensor in design monitoring, many new moving sensors have been structured and studied from non-junction measurement. Where, the photogrammetry and the laser displacement sensors are the most moving sensors which representative at ones [5].

By side the rate of new sensor is often have high-priced, adding number of trouble in acceleration and stability, or in empirical use[6]. Where, in the next side the last do not implement the inactive Wireless communication evaluation, exactly normal sensor, so indicated

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that the new sensor could still having in the complex static configuration monitoring[2],[5],[6].

There are some of paper are near form this work or study the helix antenna and the other types of antenna where these papers and articles also reviews too, are published in IEEE or some other important and scopas and international journals.

In 2014 huang H and with other authors, they was proposed a helix antenna liquid level sensor as shown in reverence[7]. And in [8] Jiang C. and et al at 2016 they studied simulation of of RFID based folded patch antennas. While in [9,10] other authors are study different types of sensors at the same type of the antenna in [8].

So on this paper the scope is studying the displacement sensor by taking the resonant frequency as arranged of distance measurement

and in next section design the helix antenna by using HFSS: "high frequency structure simulator" according to study the analyzation of the helix antenna, at last the design shows the high linearity with obtained uniform range after parameter optimization[8].

2. Methology

This part includes theoretical study by studying the helix antenna according to perturbation theory by choosing large number of turns. which is, consists of a set of equations about the theoretical aspect. The collected data analyzed to reach a set of conclusion about the validity of the research hypothesis by clarifying and explaining the results according to the mechanism and importance of the helix parameters This part starts with demonstrating the resonant frequency as shown in equation 1. :

$$\frac{f-f_0}{f_0} = \frac{\int_{\Delta V} (\mu \|\vec{H}_0\|^2 - \epsilon \|\vec{E}_0\|^2) dv}{\int_{V_0} (\mu \|\vec{H}_0\|^2 + \epsilon \|\vec{E}_0\|^2) dv} \quad (1)$$

Where:

ϵ : the relative dielectric

μ : the magnetic permeability

ΔV : difference of shape disturbance

V_0 : resonant medium resonator

f_0 : initial frequency

f : resonant frequency

however the electromagnetic field along the cylindrical direction z is almost constant in helical coil, as shown in equation 2. In adding, equation 3. :

$$\|\vec{H}_0\| = H(x, y) \quad (2)$$

$$\|\vec{E}_0\| = E(x, y) \quad (3)$$

Where:

x : the cylindrical of x-axis horizontal direction.

y : the cylindrical of y- axis vertical direction.

By substituting both of eq.2 and eq.3 in eq. 1 according to the height for the non conductor material where it height will be from h_0 to h which h resulting the formula that shown in equation 4. :

$$\frac{f - f_0}{f_0} = \frac{\int_{\Delta h} \left[\int_S (\mu H^2(x, y) - \epsilon E^2(x, y)) dx dy \right] dz}{\int_{h_0} \left[\int_S (\mu H^2(x, y) + \epsilon E^2(x, y)) dx dy \right] dz} \quad (4)$$

According to the above equation the equation 5. will be:

$$\frac{f}{f_0} = C \frac{h - h_0}{h_0} \quad (5)$$

Where the last equation is excellent for the helix antennas with a big number of the helical turns, according to the obtained uniform magnetic and

electric fields. Figure 1. Shows the helix antenna before Adding the AOS, which designed by using MATLAB software program.

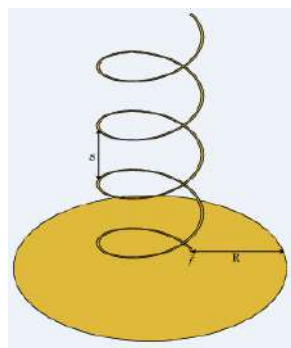


Figure 1. the helix antenna designed by matlab program.

The analysing photo for helix antenna by adding aliminm oxide strip shows in figure 2.

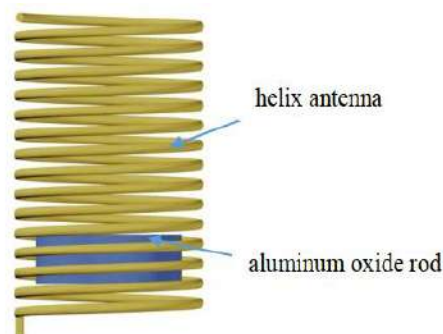


Figure 2. the helix antenna by adding AOS

3. Simulation Results

The aim of this paper is to provide a new design of passive wireless displacement sensor. The sensor consists of an external helix antenna and an AOS which meaning as menshined before in the abstract aliminem oxide strip. there is an near linear relation ship between the moving of AOS in

the space gap and in the vibrating frequency of helix antenna authority of the perturbation theory,

Which design the helix antenna by using HFSS: "high frequency structure simulator" according to study the analyzation of the helix antenna. Where HFSS is defining as an software of

simulation for electromagnetic basing on the (FEM) to simulate the characteristic of helix antenna sensor radiation, where figure 3. Shows the helix antenna designing by the HFSS

software program alone without add any thig to it, so to see how difference between of them parameter without AOS vs. with AOS.

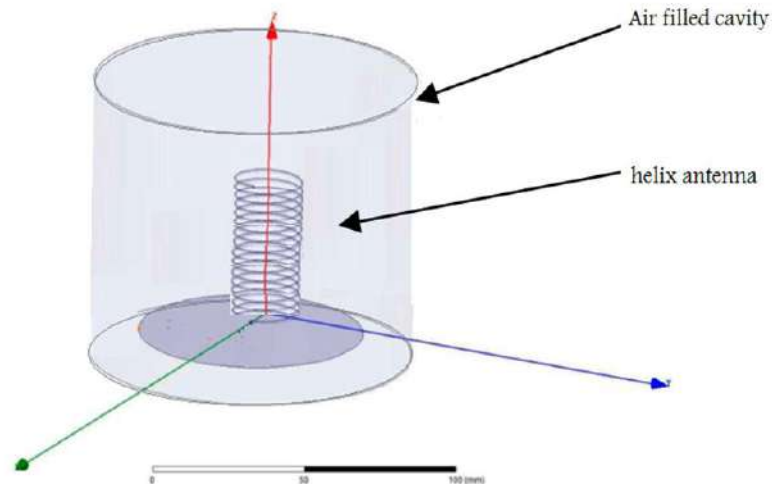


Figure 3. the helix antenna desigend before adding the AOS by HFSS.

Figure 4. shows the helix antenna by adding aliminm oxide strip (AOS) by using HFSS, where the number of turns for the helix antenna is 15 turn, whilw the length of the AOS is 5 mm, radius

for the helix antenna and AOS is 11. 22 mm , 9 mm respectively, accordig to the material was copper used for the helix antenna as shown in figure5.

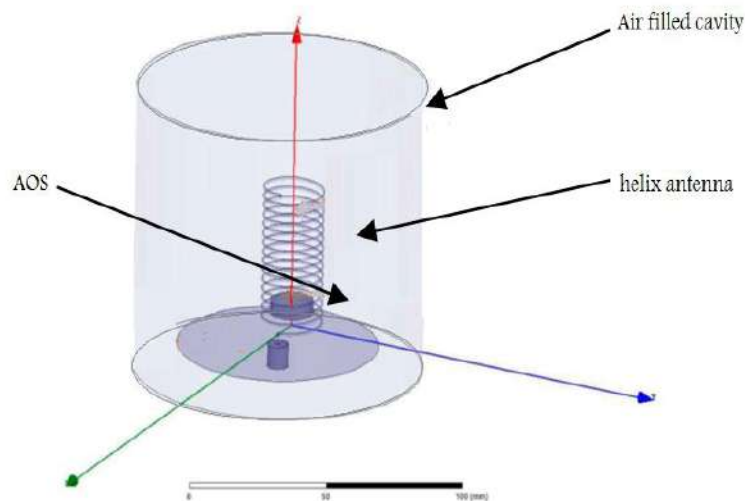


Figure 4. the helix antenna desigend after Adding the AOS by HFSS



Figure 5. the copper helix antenna material

The simulation result indicate that the sensor of the determined range has good linearity and sensitivity.

4. Conclusion

This paper provided a current design of passive WIFI moving sensor. The sensor consists of an outside helix antenna and an inside aluminum oxide strip (AOS) material. As maintained to the perturbation theory, it was an approximate or near linear relationship between the moving of AOS material in the hollow & resonant frequency of the helix antenna. Owing to the structure of the sensor. In this paper, at first designed made for the HELIX by using MATLAB software program just only the helix antenna, then the AOS material strip added to the helix antenna according to the MATLAB program. In the Second step there was in mathematical in numerical analysis and carried out the parameter optimization through HFSS of the helix antenna without the material AOS, at last step there was added the AOS to the helix antenna. Then design a real helix antenna by using copper material. According to result achieved that the sensor of the determined range has good linearity and sensitivity.

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