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APPLICATIONS OF RF MICROELECTROMECHANICAL SYSTEMS IN WIRELESS NETWORKS

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***Abstract*- Microelectromechanical frameworks (MEMS) are the innovation of little gadgets which blends both mechanical and electronic gadgets on a solid microchip to deliver better execution over strong state parts, particularly for remote applications. Famous MEMS switches for remote applications incorporate transmit/get duplexers, band-mode choice, time delay for staged cluster radio wires, and reconfigurable reception apparatuses. This paper discusses the utilization of MEMS switches in conjunction of fractal radio wires to accomplish multi-recurrence, reconfigurable reception apparatuses that can be utilized for an assortment of correspondence applications and how micromachining can be utilized to manufacture new 3-D MEMS recieving wire structures for high recurrence applications.**

***Key Terms*- Re-configurable antennas, Numerical integration wideband, fractal, RFMEMS.**

I. INTRODUCTION

Polarization and radiation design re-configurability, and recurrence tunability, are normally accomplished by consolidation of semiconductor segments, for example, varactor diodes. Be that as it may, these segments can be promptly supplanted by RF MEMS changes keeping in mind the end goal to exploit the low inclusion misfortune and high Q factor offered by RF MEMS innovation. What's more, RF MEMS parts can be coordinated solidly on low-misfortune dielectric substrates, for example, borosilicate glass, though compound semi-protecting and passivated silicon substrates are for the most part lossier and have a higher dielectric consistent. A low misfortune digression and low dielectric consistent are of significance for the proficiency and the data transfer capacity of the radio wire.

By joining low-misfortune, high-detachment RF MEMS switches with resounding microstrip or fractal radiators, we can physically reconfigure radio wires and their bolster structures keeping in mind the end goal to give recurrence band and polarization decent variety. The MEMS smaller scale transfers are utilized to on the other hand interface or detach sub-structures on the planar reception apparatus component, making a geometrically particular radiator for every blend of switch positions. What's more, stage shifters can be utilized as a part of conjunction with numerous radio wire components to acknowledge novel solid ease electronically steerable exhibits (ESAs). These ESAs will encourage future combination with dynamic gadgets and flag processors to acknowledge 'brilliant' reception apparatus. Inactive subarrays in view of RF MEMS stage shifters might be utilized to bring down the measure of T/R modules in a dynamic electronically examined cluster. RF bandpass channels can be utilized to increment out-of-band dismissal, in the event that the recieving wire neglects to give adequate selectivity. Before, re-configurable recieving wires have been confined to the utilization of non-fractal components. Here the utilization of fractals is for the most part for multi-recurrence applications. A fractal recieving wire can be intended to get and transmit over an extensive variety of frequencies.

II. RF MEMS

MEMS RF contact switch has bring down inclusion misfortune for multi-mode applications. They have prevalent confinement/music with execution, 15dB more noteworthy contrasted and strong state. The radio recurrence microelectromechanical framework (RF MEMS) acronym alludes to electronic segments of which moving sub-millimeter-sized parts give RF usefulness. RF MEMS resonators are connected in channels and reference oscillators. RF MEMS switches, exchanged capacitors and varactors are connected in electronically checked subarrays, stage shifters and reconfigurable reception apparatuses, tunable band-pass channels.

III. FRACTAL ANTENNAS

A fractal recieving wire is a reception apparatus that uses a fractal, self-comparative outline to expand the length, or increment the border (on inside areas or the external structure), of material that can get or transmit electromagnetic radiation inside a given aggregate surface region or volume.

Such fractal recieving wires are likewise alluded to as multilevel and space filling bends, yet the key perspective lies in their redundancy of a theme more than at least two scale sizes or "cycles". Thus, fractal radio wires are exceptionally reduced, multiband or wideband, and have valuable applications in cell phone and microwave interchanges.

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A fractal radio wire's reaction contrasts notably from customary reception apparatus plans, in that it is equipped for working with great to-phenomenal execution at a wide range of frequencies at the same time. Typically standard radio wires must be "cut" for the recurrence for which they are to be utilized—and therefore the standard reception apparatuses just function admirably at that recurrence. This makes the fractal radio wire a superb outline for wideband and multiband applications. Also the fractal idea of the reception apparatus shrivels its size, without the utilization of any parts, for example, inductors. The fractal reception apparatus has execution parameters that rehash intermittently with a self-assertive "fineness" subject to the cycle profundity. In this manner, in spite of the fact that the limited cycle profundity fractal recieving wire isn't recurrence autonomous, it can cover recurrence groups self-assertive near one another. Additionally, recalling that radiation originates from quickening charges, the run of the mill fractal shape (with every one of those little twists and wrinkles) makes for good radiation (higher radiation protection) on account of all that increasing speed going ahead as the charges are compelled to arrange each one of those sharp turnstors or capacitors.

IV. THE SIERPINSKI ANTENNA

Fractals have self-similarity in their geometry, which is a feature where a section of the fractal appears the same regardless of how many times the section is zoomed in upon. Self-similarity in the geometry creates effective antennas of different scales. This can lead to multiband characteristic antennas, which is displayed when an antenna operates with a similar performance at various frequencies.

The Sierpinski Gasket antenna is used for this paper. A bowtie dipole antenna generates the fractal. The middle third triangle is removed from the bowtie antenna, leaving three equally sized triangles, which are half the height of the original bowtie. The process of removing the middle third is then repeated on each of the new triangles.

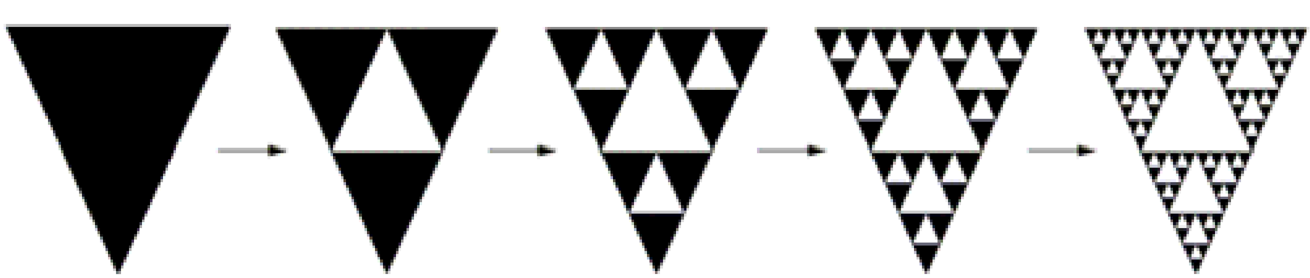

Fig. 1- Generation of Sierpinski Antenna Pattern

The Sierpinski Gasket antenna has the following characteristics:

The antenna has a flare angle of 60" and provides constant radiation pattern all over its bandwidth. Each element's side-length is 2.7cm. The antenna is etched on a monopole, which is placed vertically on a ground plane to create an image. It is then fed from the tip using a coaxial cable whose outer metal is connected to the ground plane and its inner conductor to the monopole itself.

The benefits of the multiband behavior can be seen in the far field pattern plots for these antennas. The far field patterns for the antennas at their first, second, and third resonances are shown in Fig 2,3 and Fig 4.

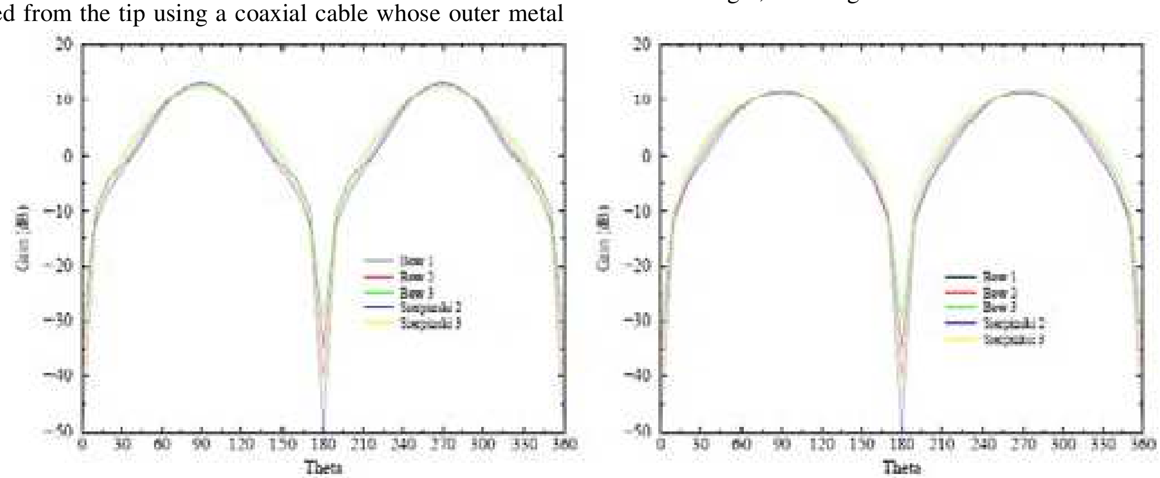

Fig. 2- Far field pattern (first resonances)

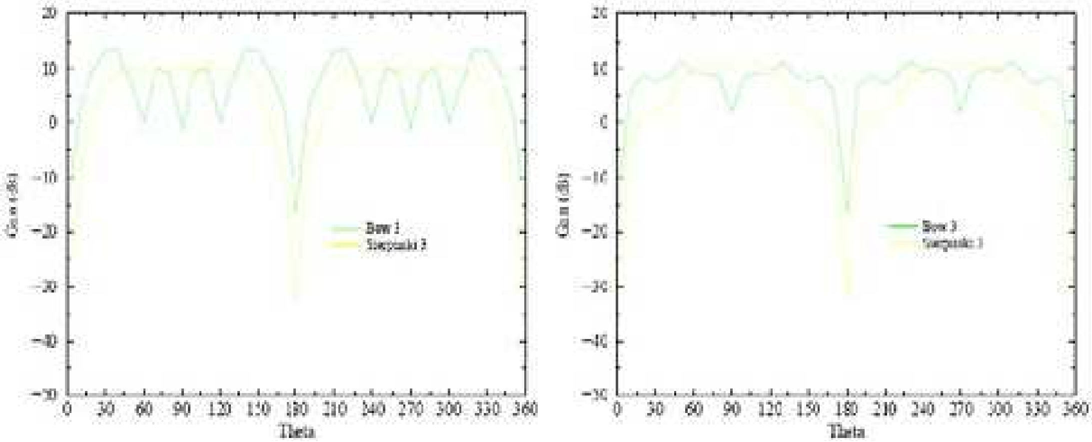

Fig. 3- Far field pattern (third resonances)

The above figures show the effect of use of Sierpinski fractal antennas on the far field patterns.

The Sierpinski pattern has a multi-frequency performance, as its active shape can be altered in many different ways providing different current paths, frequency bands and radiation patterns.

The radiation pattern of the fractal antenna is similar to that of a dipole antenna as shown in Figure 4.

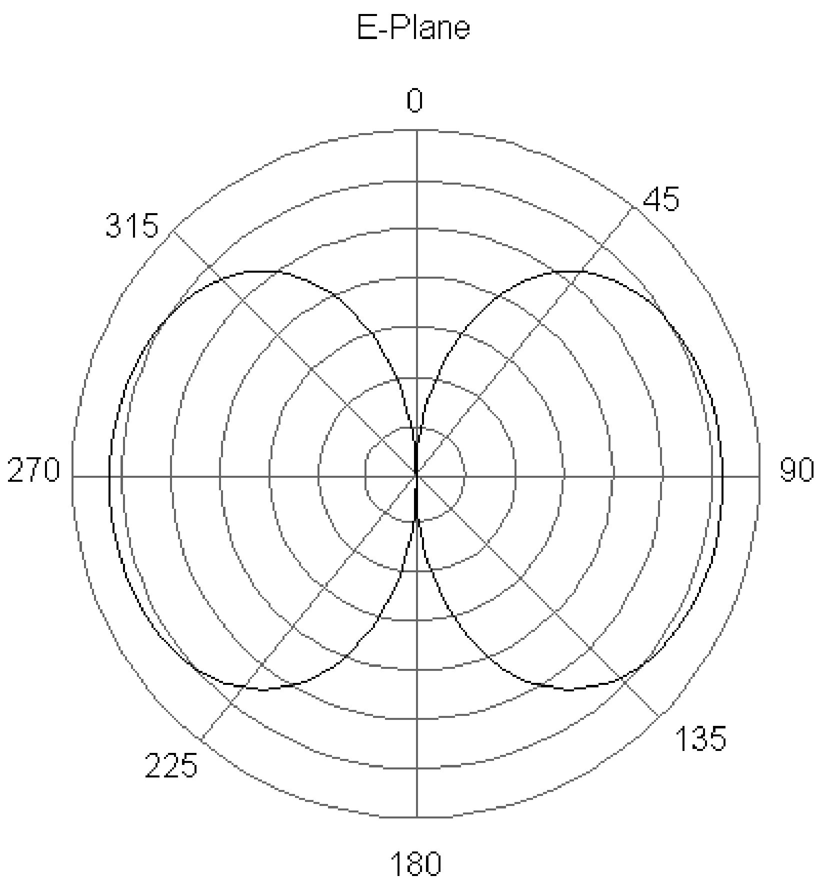

Fig. 4-The radiation pattern of a fractal antenna with all switches off

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V. ANTENNA AND MEMS SWITCHES

In general, the coupling between the elements of a fractal antenna is very weak. Here we consider that the elements are connected with almost ideal switches. Therefore a switch conductively connects two adjacent antenna's elements when it is activated, changing the antenna's physical dimensions. Small gaps are created in the etched fractal antenna, which are bridged using MEMS switches.

Several cases were analyzed with the switches turned ON and OFF at different locations of the fractal antenna. First, the antenna was simulated with all switches set to ON (i.e. the antenna acted as regular fractal antenna with all of its conductive parts connected to each other).

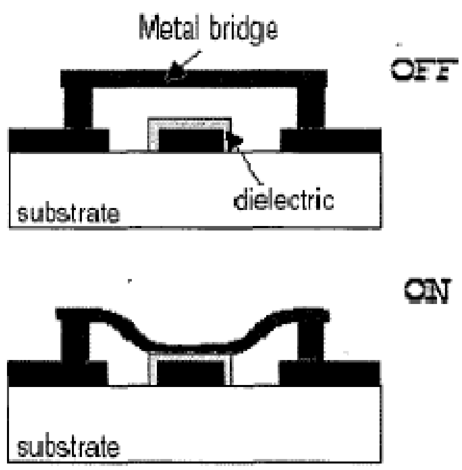

Fig. 5- Side view of a shunt MEMS switch

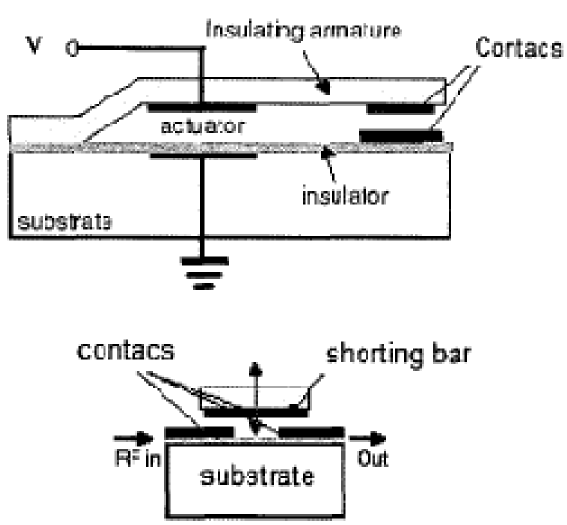

Fig. 6 -Side and front view of a series MEMS switches

VI. THz ANTENNAS USING MICROMACHINING

Micromachining can also be used to fabricate 3 Dimensional structures, such as helical antennas, singular and arrayed, for the millimeter and THz range. The THz antenna structures are fabricated by using Laser Chemical Vapor Deposition (LCVD) to form fibers that can be grown into complex three dimensional structures directly on semiconductor substrates. By focusing the laser through a diffractive optic, arrays of antennas can be fabricated at the same time.

Several applications can be realized using the antenna structures with other THz MEMS devices such as THZ waveguides, bolometers etc. An MEMS helical antenna has been shown in Fig. 7.

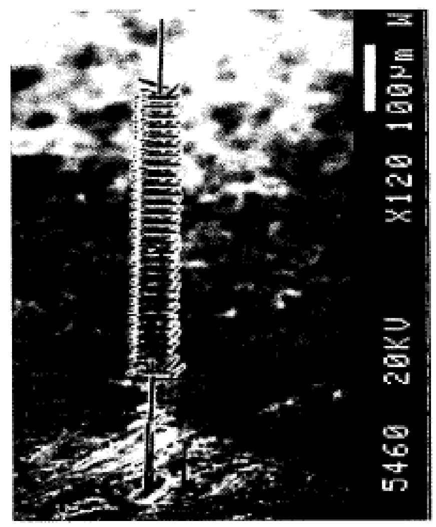

Fig. 7 A MEMS Helical Antenna

VII. ADVANTAGES AND DISADVANTAGES OF FRACTAL ANTENNAS

Advantages include minituratization, better input impedance matching, wideband/multiband, frequency independent, reduces mutual coupling among fractal antennas.

Disadvantages include gain loss, complexity and numerical limitations. Also, the benefits begin to diminish after a few iterations.

VIII. APPLICATIONS OF FRACTAL ANTENNAS

The sudden development in the remote correspondence territory has sprung a requirement for conservative incorporated reception apparatuses. The space sparing capacities of fractals to productively fill a restricted measure of room make particular favorable position of utilizing coordinated fractal recieving wires. Cases of these sorts of uses incorporate individual hand-held remote gadgets, for

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example, PDAs and different remote cell phones, for example, portable workstations on remote LANs and networkable PDAs.

Fractal reception apparatuses can likewise enhance applications that incorporate multiband transmissions. This region has numerous potential outcomes running from double mode telephones to gadgets incorporating correspondence and area administrations, for example, GPS, the worldwide situating satellites. Fractal reception apparatuses likewise diminish the region of a thunderous recieving wire.

IX. CONCLUSIONS

Another way to deal with various recurrence fractal reception apparatuses utilizing RF MEMS switches was introduced. Rather than using just the reverberation frequencies offered to the architect by the idea of the fractal radio wires, extra resonances can be accomplished by making utilization of RF MEMS switches. The arrangement of each switch can control the current on each conductive piece of a fractal radio wire. That influences the reverberation conduct of the whole radio wire and its radiation design. A few other fractal radio wires, for example, the Sierpinski gasket reception apparatus can be utilized as a part of conjunction with FW MEMS changes to make a re-configurable and more flexible recieving wire. Such a way to deal with re-configurable reception apparatuses licenses think adjustments in radio wire execution to oblige changes in mission, condition, resilience to imperfections and blames in current correspondence frameworks.

Additionally work is required to get a comprehension of the connection between the execution of the radio wire and the fractal measurement of the geometry that is used in its development. It is vital that the outline of the radio wire approaches a perfect fractal however much as could reasonably be expected. A few emphasess can be concentrated to comprehend the patterns that oversee the radio wire to better comprehend the material science of the issue.

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