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Projects done in the year of 2017-18

1.Simulation of Wireless Power Transfer using circular loop antennas

Guided by: Mr. Pradeep Kumar K

ABSTRACT:

Wireless power or remote transmission of electrical vitality from a power source to an electrical load without man made conduits. It is helpful in situations where interconnecting wires are badly arranged, dangerous or incomprehensible. It is completed utilizing direct acceptance took after thunderous attractive enlistment, electromagnetic radiation as microwaves or lasers and electric conduction through media. This framework now daily is exceptionally prevalent everywhere throughout the world. Radio waves are the vitality and individuals utilize them to send and get phone, TV, radio, Wi-Fi signals every day. This innovation now daily has a wide decent footing everywhere throughout the world. This innovation today has sufficiently developed to permit us another way to control our portable and devices.

The idea of remote power exchange has been presented since the nineteenth century. Full circuits were utilized to improve the transmission run. It is realized that electromagnetic vitality likewise connected with the proliferation of the electromagnetic waves. We can utilize hypothetically all electromagnetic waves for a remote power transmission (WPT). The distinction between the WPT and correspondence frameworks is just proficiency. Despite the fact that we transmit the vitality in the correspondence framework, the transmitted vitality is diffused to all bearings. The got control is sufficient for transmission of data; the effectiveness from the transmitter to beneficiary is calm low.

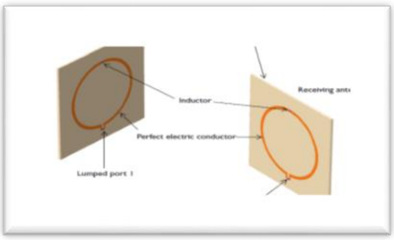

Figure1: Model set up to compute the coupling effect between two circular loop antennas based on the receiving antenna

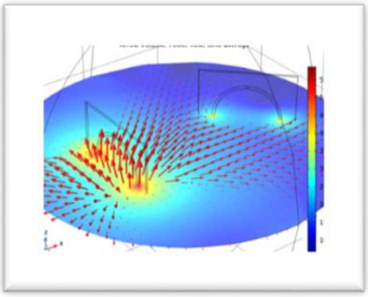

Figure2: Plot of E-field norm and power flow at z = 0 while the receiving antenna is rotating from 0 to 90 degrees with a step of

2.Simulation of Microgripper using MEMS Comsol

Student own executed project

The actuator is made of lead zirconate titanate (PZT-5A), and the gripper itselfconsists of polycrystalline silicon (poly-Si). Both materials are available in COMSOLMultiphysics' material libraries. The material properties are prescribed using therotated coordinate system.

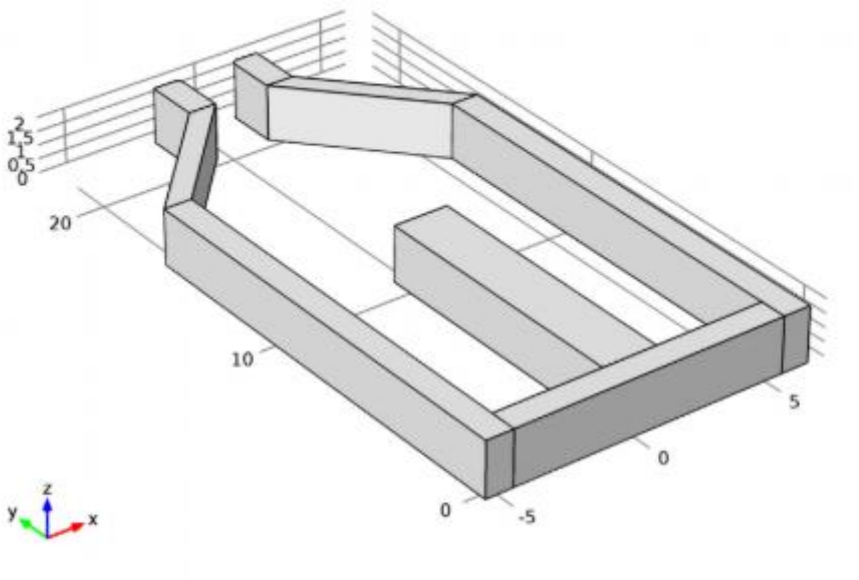

Figure 1: Microgripper geometry. The part in the middle represents the piezoelectric Actuator.

ABSTRACT:

A Micro Electro Mechanical System (MEMS) based piezoelectric actuator is a micromechanical device that produces parallel movement of gripping arms by piezoelectric material. Piezoelectric actuated microgripper used to grip and handle the miniature parts wherestudy of displacement with voltage are important. In this paper two typical design of micro gripper w.r.t. different actuator heights andwidths are presented and analyzed. After analyzing, the previoustwo designs (which gives less jaw movement and higher voltage)we present a novel microgripper mechanism based on specificdesign requirements for micromanipulation. This microgripper is designed in COMSOL designing tool for the piezoelectric materials such as lead zicronatetitanate (PZT), have been designed to achievedisplacement at low voltage. The performance of the microgripper and the results show that the microgripper can grasp micro objectswith the maximum jaw motion of 1.3008µm corresponding to the2400-V applied voltage.

3.Design and Simulation of MEMS Capacitive Pressure Sensor for High Sensitivity Applications

Guided by: MR. SUSHANTH ANIL LOBO

ABSTRACT:

Capacitive pressure sensor is simply a diaphragm-type device in which the diaphragmdisplacement is determined by measuring the capacitance change between the diaphragm and a metal plate that is close to it. Such devices are in common use. In capacitive pressure sensor the sensing element is a taut metal diaphragm located equidistant between two stationary metal surfaces, comprising three plates for a complementary pair of capacitors. An electrically insulating fill fluid (usually a liquid silicone compound) transfers motion from the isolating diaphragms to the sensing diaphragm, and also doubles as an effective dielectric for the two capacitors. Any difference of pressure across the cell causes the diaphragm to flex in the direction of least pressure. The sensing diaphragm is a precision-manufactured spring element meaning that its displacement is a predictable function of applied force. The applied force in this case can only be a function of differential pressure acting against the surface area of the diaphragm in accordance with the standard force-pressure-area equation $F = PA$. In this case, we have two forces caused by two fluid pressures working against each other, so our force-pressure-area equation may be rewritten to describe resultant force as a function of differential pressure $(P1 - P2)$ and diaphragm area: $F = (P1 - P2)A$. Since diaphragm area is constant and force is predictably related to diaphragm displacement, all we need now in order to infer differential pressure is to accurately measure displacement of the diaphragm.

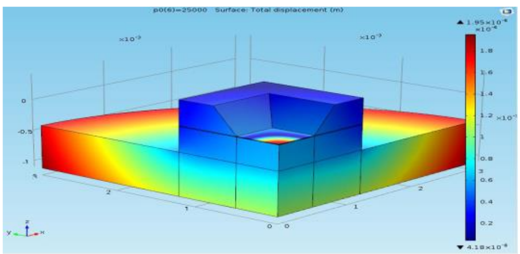

Figure 1: Model of thermal stress analysis

4.Design And Simulation Of MEMS Surface Acoustic Wave Sensor

Submitted by : **SATISH NAYAK**
PRABHAKARA
RAINA BENITA LOBO
VARSHITHA C R
Guided by: **Dr. D V MANJUNATHA**

ABSTRACT:

Surface Acoustic Wave (SAW) technology can be applied to create highly sensitive biosensors due to its extreme sensitivity to surface perturbation. The velocity of an acoustic wave depends upon the mass, density and stiffness of the piezoelectric substrate. The binding of antigens with antibodies, when immobilized in the path of the traveling wave, changes the mass of the biolayer. The mass loading effect perturbs the surface boundary which changes the velocity of the wave and consequently shifts the frequency of the traveling SAW. With a pair of transmitting and receiving Inter-Digitated Transducers (IDT), high frequency SAWs can be generated through radio frequency interrogation at the free surface of piezoelectric material. In the future, bio-molecule immobilization and optimization of the sensors are necessary to develop fully functional devices.

Micro Electro Mechanical Systems (MEMS) technology is a process technology used to create timing integrated devices or systems that combine mechanical and electrical components. MEMS technology exploits the existing microelectronics infrastructure to create complex machines on a micrometer scale. Extensive applications for these devices exist in both commercial and industrial systems. Well-known components such as integrated silicon pressure sensors, accelerometers and motion detectors have found use for several years in automotive and industrial applications.

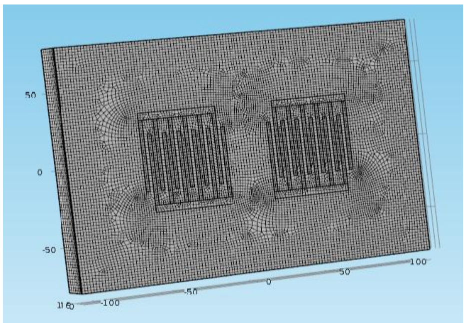

Figure 1: Meshed Structure of SAW Sensor

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A Review on Surface Acoustic Wave Sensor

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Alva's Institute of Engineering and Technology, Mijar, Moodbidri-574225, Mangaluru, Karnataka, India

***Abstract*— Surface Acoustic Wave (SAW) technology can be applied to create highly sensitive biosensors due to its extreme sensitivity to surface perturbation. The velocity of an acoustic wave depends upon the mass, density and stiffness of the piezoelectric substrate. The binding of antigens with antibodies, when immobilized in the path of the traveling wave, changes the mass of the biolayer. The mass loading effect perturbs the surface boundary which changes the velocity of the wave and consequently shifts the frequency of the traveling SAW. With a pair of transmitting and receiving Inter-Digitated Transducers (IDT), high frequency SAWs can be generated through radio frequency interrogation at the free surface of piezoelectric material. In the future, bio-molecule immobilization and optimization of the sensors are necessary to develop fully functional devices.**

Keywords: **SAW sensor, Inter-digitated transducer, piezo-electric materials, MEMS.**

I. INTRODUCTION

Micro Electro Mechanical Systems (MEMS) technology is a process technology used to create timing integrated devices or systems that combine mechanical andelectrical components. MEMS technology exploits the existing microelectronics infrastructure to create complex machines on a micrometer scale. Extensive applications for these devices exist in both commercial and industrial systems. Well-known components such as integrated silicon pressure sensors, accelerometers and motion detectors have found use for several years in automotive and industrial applications.

Biosensor is an analytical device used for the detection of an analyte that combines a biological component with a physicochemical detector.

SAW sensors are a subset of acoustic wave sensor devices. Acoustic wave sensor are very versatile in that they may be used alone or as a part of a filtered sensor to measure many phenomena.

II. MOTIVATION

The early detection of cancer can significantly reduce cancer mortality and saves lives. Thus, a great deal of effort has been devoted to the exploration of new technologies to detect early signs of the disease. They can be used for risk assessment, diagnosis, and prognosis and for the prediction of treatment efficacy and toxicity and recurrence.

III. BIOSENSOR

Biosensors work with the principle of the interaction of the analytes that need to be detected with biologically derived bio-molecules, such as enzymes of certain forms, antibodies and other form of protein. These biomolecules, when attached to the sensing element, can alter the output signals of the sensors when they interact with the analyte. Proper selection of biomolecules for sensing elements can be used for the detection of specific analyte.

Importance of Biosensors

Biosensors have expanded giving rise to a vast frontier of interdisciplinary research that combines biology, analytical chemistry, physics and bio-electronics. From the first bulky biosensors built as academic curiosity, the field has shown a great deal of attractiveness thus becoming a research area that has successfully commercialized devices for multiple applications in a market that is worth many billion dollars. Different uses in medico-clinical, environmental, food-agricultural, security and forensic science, and other fields are making these devices increasingly popular. The question of defining what can be considered as a biosensor is difficult, but the most accepted concept nowadays is to be a device comprising of a biological recognition element attached or integrated into a transducer.

Application of Biosensor

Biosensors have been applied in many fields namely food industry, medical field, marine sector etc., and theyprovide better stability and sensitivity as compared with thetraditional methods.

Types of Biosensors

There are different types of biosensors based on the sensor devices and the biological materials and some of them are discussed below.

1. Electrochemical Biosensor

Electrochemical biosensor is a simple device. It measures the measurement of electronic current, ionic or by conductance changes carried by bio-electrodes.

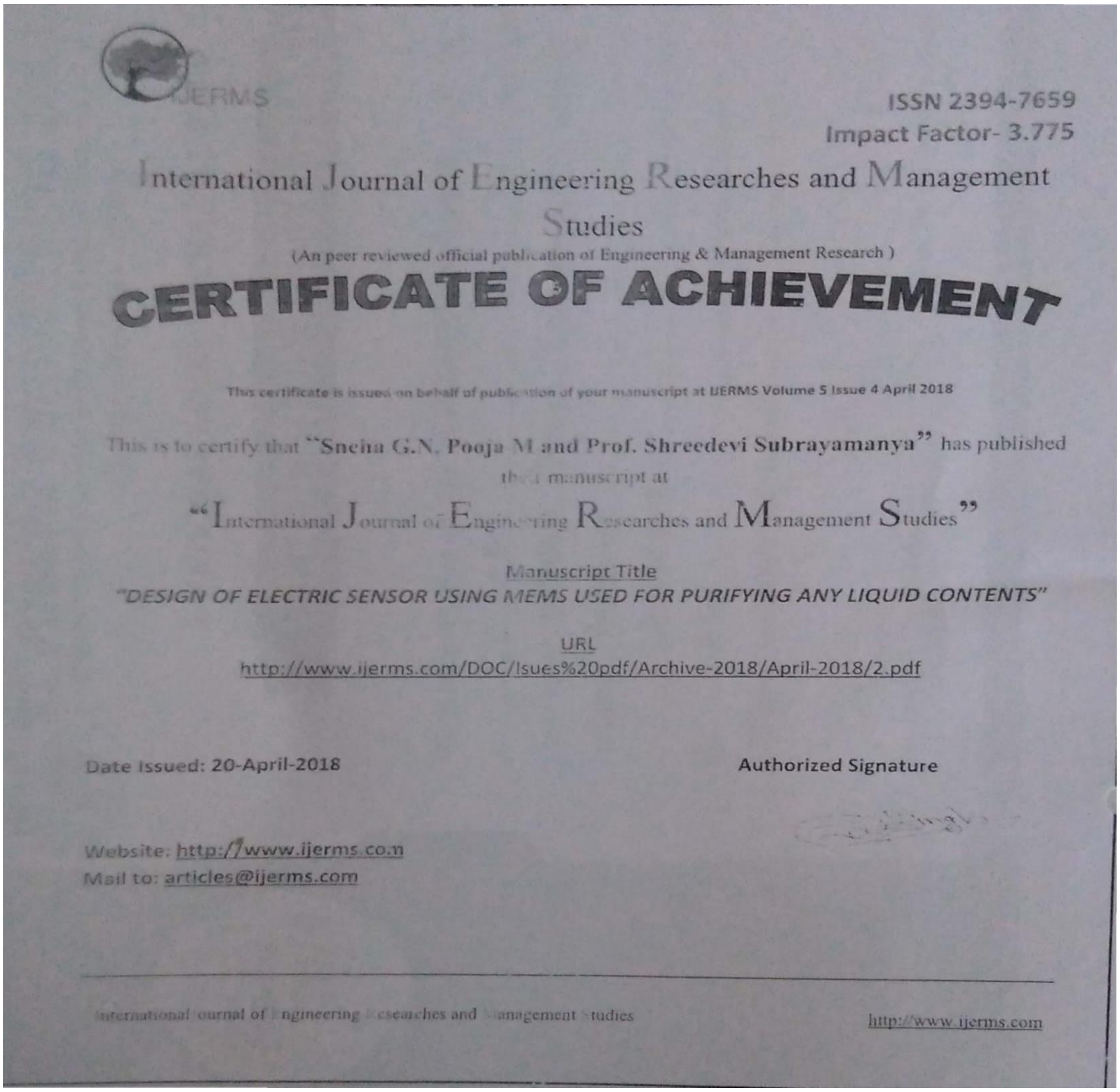
2. Amperometric Biosensor

The biosensors are based on the electron's movement, i.e. electronic current determination as a reaction of enzyme-catalyzed redox reaction. Generally a normal contact voltage passes through the electrodes to analyze. In the enzymaticreaction which produces the substrate or product can transfer the electrons with the surface of electrodes to be reduced.

PAPER PRESENTATIONS IN THE YEAR 2017-2018

1.Design Of Electro Sensor Using MEMS Used For Purifying Liquid Contents

Presented by **SNEHA G N**
POOJA M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"DESIGN OF ELECTRIC SENSOR USING MEMS USED FOR PURIFYING ANY LIQUID CONTENTS"

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DESIGN OF ELECTRIC SENSOR USING MEMS USED FOR PURIFYING ANY LIQUID CONTENTS

Sneha G.N[1], Pooja M[2], Prof. Shreedevi Subrayamanya[3]
[*1&2]UG Student Dept. of ECE, AIET Moodbidri
[3]Asst. Professor, Dept. of ECE, AIET Moodbidri

ABSTRACT

Electric sensor examines the change in electric or magnetic signals based on a environmental input. A sensor is a device that measures a particular characteristic of an object or system. Some sensors are purely mechanical, but most sensors are electronic, returning a voltage signal that can be converted into a useful engineering unit. Sensors take advantage of the mechanical or electrical response of its component to relate the response to a relevant quantity. Engineers use sensors in test and monitoring applications, but home owners interact with sensors every day. Automobiles are filled with sensors, from the engine to the airbag. We are interested in the development of mems technologies, where the emphasis is on minimizing cost, and the ratio of performanceof minimizing cost rather then maximizing performance. As the materials serve as the basis for this exploratory progress, a conceptually selected effort to reduce the cost of diagnostic systems by developing electric sensor.

Keywords: RADAR, AIRBAG, SENSORS, WATER PURIFIER

1. INTRODUCTION

In the broadest definition, a sensor is a device, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics, whether as simple as a light or as complex as a computer.

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances in micromachinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, pressure or flow measurement, for example into MARG sensors. Moreover, analog sensors suchas potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine, robotics and many other aspects of our day-to-day life.
A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C (it is basically the slope Dy/Dx assuming a linear characteristic). Some sensors can also affect what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors are usually designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as microsensors using MEMS technology. In most cases, a microsensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches.

1.1 Electric Sensor

This is a model from electric impedance tomography, a method of imaging the interior permittivity distribution of a body by measuring current and voltage at the surface.

This model demonstrates how the shape and placement of figures with different material properties inside a closed box can be determined with this non-invasive technique. Applying a potential difference on the boundaries of the box gives rise to a surface charge density that varies depending on the permittivity distribution inside the box.

The technique can be used in, amongst other applications, medical diagnosis. Different organs have different properties so that you can "see" the organs and their movement from the permittivity "image" that they create.

2. Review Paper On Designing And Stimulation Of MEMS Based Electric Sensor

Presented By **VARSHITHA P J**
SNEHA G N

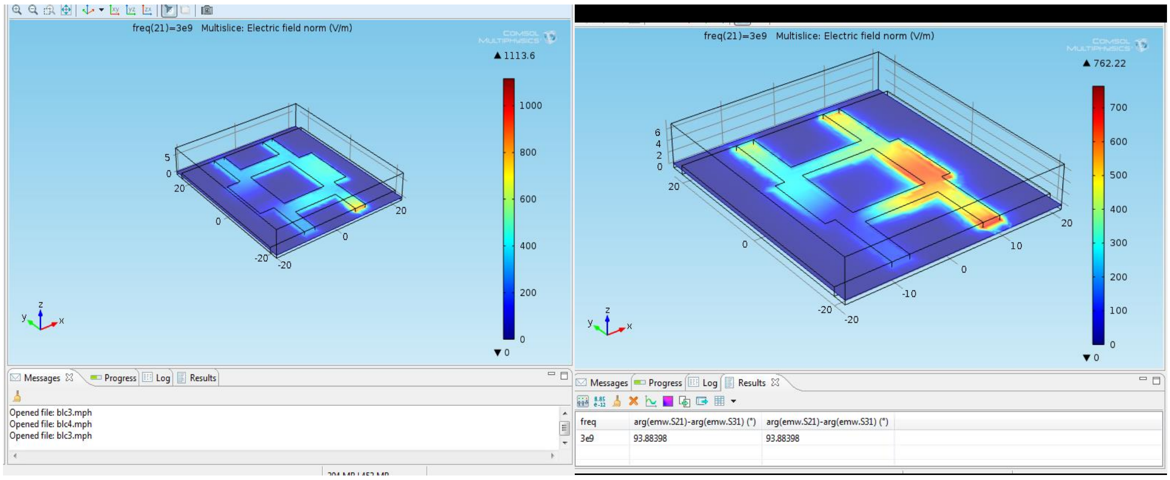
Projects done in the year of 2016-17

1. Simulation of Branch Line Coupler using MEMS

Guided by: MR. PRADEEP KUMAR K

ABSTRACT:

A Branch Line coupler is a device which can be used as single transmitting/ receiving antenna or can be used as splitter or combiner. The branch line couplers are very small and high performance devices in communication and microwave industry. A branch line coupler has plenty of wireless applications in the design of microwave and RF devices, Viz. balance amplifiers, mixers and phase shifters, antenna/array feeding networks etc., the branch line couplers uses quarter wave length transformers. In order to realize Simple Square shaped configuration for dividing the power or combining the power in low cost fabrication. However, the reduction of size plays important role at low frequencies. Hence, the size reduction of the device is highly desirable in modern communication systems.



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Design and Simulation of Branch Line Coupler using MEMS Comsol Multiphysics

Vasanth Kumar M[1], Gowda Rachita B V[2], Prof. Pradeep Kumar K[3]

Department of Electronics & Communication Engineering

[1-2] Fifth Semester UG Students, AIET, Moodbidri, Karnataka, India.

[3]Assistant Professor, AIET, Moodbidri, Karnataka, India.

Abstract: **- A Branch Line coupler is a device which can be used as single transmitting/ receiving antenna or can be used as splitter or combiner. The branch line couplers are very small and high performance devices in communication and microwave industry. A branch line coupler has plenty of wireless applications in the design of microwave and RF devices, Viz. balance amplifiers, mixers and phase shifters, antenna/array feeding networks etc., the branch line couplers uses quarter wave length transformers. In order to realize Simple Square shaped configuration for dividing the power or combining the power in low cost fabrication. However, the reduction of size plays important role at low frequencies. Hence, the size reduction of the device is highly desirable in modern communication systems.**

I. OBJECTIVES OF THE PROJECT

The objectives which we met by this design and simulation is

- High selectivity of various materials.
- Reducing insertion loss.
- Limiting on coupling loss.
- Control over return loss.
- Reduction of impedance.
- Various operating frequency.

Tools Used

- Operating System: Windows 10 / Unix / Linux
- Application Software's: COMSOL Multiphysics 4.3, Coventor ware

II. PROPOSED SYSTEM

In modern communication systems, various characteristics such as miniaturization and low-cost fabrication are required for passive circuit design. Therefore, compact branch-line couplers are important passive components that need to be enhanced.

- The miniaturization for various reports concerning the size reduction.
- The miniaturization method has a size reduction about 51%.
- Size reduction about 71% is achieved using symmetrical T- shaped structure.

In the past years, there has been great improvement in various reports concerning the size reduction. The miniaturization is achieved by using artificial transmission lines consisting of microstriplines periodically loaded with open-circuit shunt stubs in place of transmission lines, and this method has a size reduction about 51%. Size reduction about 71% is achieved using symmetrical T-shaped structure with quasi- lumped elements.

III. STEPS IN DESIGN METHODOLOGY

Selection Physics

In the model wizard 3D window the Radio Frequency>Electromagnetic Waves, Frequency Domain (emw) is selected. The Electromagnetic Waves, Frequency Domain Interface, found under the Radio Frequency branch in the Model Wizard, solves the electric field based time-harmonic wave equation, which is strictly valid for linear media only.

Design Parameters

Table1: parameters of branch line coupler

Name	Expression	Description
thickness	60[mil]	Substrate thickness
l_s	40[mm]	Length, substrate
w_line2	5[mm]	Width, line 2
l_line2	13[mm]	Length, line 2
l_line1	(l_s-l_line2)/2	Length, line 1
w_line1	3.2[mm]	Width, line 1
w_line3	3[mm]	Width, line 3
l_line3	13.6[mm]	Length, line 3
f_min	1[GHz]	Minimum frequency in sweep
f_max	5[GHz]	Maximum frequency in sweep
lda_min	c_const/f_max	Minimum wavelength, air
h_max	0.2*lda_min	Maximum element size, air
h_s	h_max/sqrt(3.38)	Maximum element size, substrate

* "mil" refers to the unit milliinch.

In the above table the parameters like substrate thickness, length of the substrate, width of the lines, length of the lines, maximum frequency and minimum frequency in sweep and in air are mentioned. These parameters are used to design the branch line coupler. The above given values are varied and the

2.Simulation of Coaxial Cable for different impedance using MEMS Comsol Multiphysics.

Guided by: MR. PRADEEP KUMAR K

ABSTRACT:

Coaxial cable is the type of cylindrical shape wave guide cannel used in telecommunications for transmitting information signals for larger distance. They are basically governed by electromagnetic theory. The frequency range of these EM wave cables are more than the frequency range of other cables. The main application of coaxial cable is in the transmission of video signals over a long distance without any disturbance. A method is proposed here to find out the variation of impedance of a dielectric filled transmission cable (Coaxial Cable). This paper provides the theoretical and practical measures and its comparison by using different dielectric filled coaxial cables. This paper gives the composite solution, which involves a method of cable design for different applications, using geometry size and operating frequency, in order to study the variation of characteristic impedance with respect to dielectric material variation. This work is simulated using MEMS COMSOL MULTIPHYSICS Tool

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Designing and simulation of MEMS based Coaxial cable for Different Impedances

[1] Satish Nayak, [2]Prabhakar, [3] Pradeep Kumar K, [4]Dr. D V Manjunatha4
[1][2] UG Student VI- Sem Dept. of Electronics and Communication. AIET Moodbidri 574225
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[4]Professor & Head, Dept. of Electronics and Communication. AIET Moodbidri 574225

Abstract - **Coaxial cable is the type of cylindrical shape wave guide cannel used in telecommunications for transmitting information signals for larger distance. They are basically governed by electromagnetic theory. The frequency range of these EM wave cables are more than the frequency range of other cables. The main application of coaxial cable is in the transmission of video signals over a long distance without any disturbance. A method is proposed here to find out the variation of impedance of a dielectric filled transmission cable (Coaxial Cable). This paper provides the theoretical and practical measures and its comparison by using different dielectric filled coaxial cables. This paper gives the composite solution, which involves a method of cable design for different applications, using geometry size and operating frequency, in order to study the variation of characteristic impedance with respect to dielectric material variation. This work is simulated using MEMS COMSOL MULTIPHYSICS Tools.**

Keywords: MEMS, Wave Guide Channel, EM Waves, Impedance, Video Signals.

1. INTRODUCTION

This piece of work focuses on the coax cable, its usefulness and observational parts when buying coax cable. Examining the impedance about coax cable is the major criteria while buying the cable. The basic components of a coaxial cable, from the inside out, are center conductor, dielectric, one or more shield layers and jacket (figure 1). A significant part of the cost to manufacturer coaxial cables is the outer conductor, or shield. Depending on the cable construction, the shield may use braided bare- or tinned copper wires, a conductive foil tape such as aluminum, a corrugated or smooth solid copper or aluminum tube outer conductor or some combination. It is intuitive that the more shield coverage, the better. Some shield types, such as a tubular or wrapped shield, completely enclose the dielectric and center conductor.

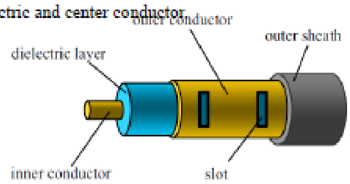


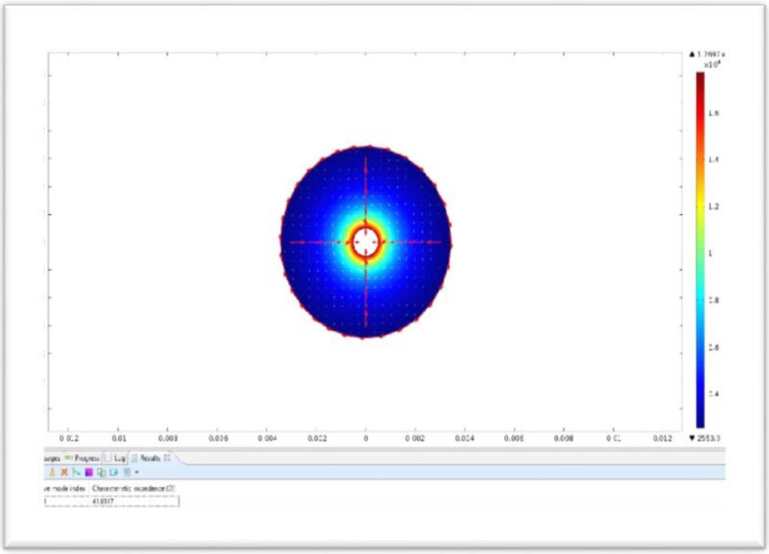
Fig 1: Coax Cable outlook.

2. CONSTRUCTION:

The center conductor may be made of various materials and constructions. Most common constructions are solid or seven-strand conductors. Solid conductors are used in permanent, infrequently handled or low flex applications and stranded conductors are used in flexible cable applications. Common materials include copper, tinned or silver plated copper, copper clad steel and copper clad aluminum. Plated copper is used to aid in solder ability of connectors or to minimize corrosion effects. Because of a phenomena known as skin-effect, copper clad materials may be used in higher frequency applications (> 50 MHz) to improve tensile strength and reduce weight and cost. (Skin-effect is the result of higher frequency signals propagating along the outermost surface, or skin, of the conductor.)
The insulation, or dielectric material, is used to provide separation between the conductors. It is desirable that the material has stable electrical characteristics (dielectric constant and dissipation factor) across a broad frequency range. The most common materials used are polyethylene (PE), polypropylene (PP), fluorinated ethylene propylene (FEP), and polytetrafluoroethylene (PTFE). PE and PP are desirable in lower cost, power, and temperature range applications (PE is 85C, PP is 105C)1. FEP and PTFE are for higher power and temperature range applications

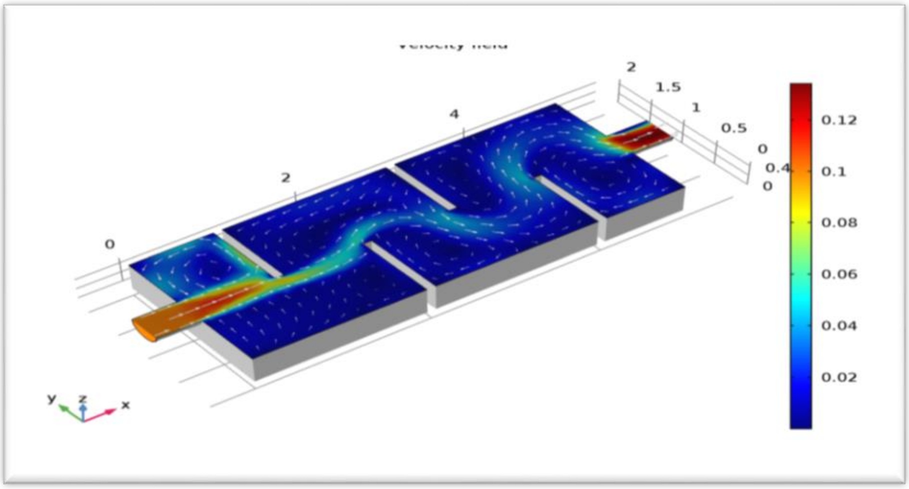
Materials	Dielectric constant	Characteristic impedance e(ohm)
Glass	7.6	41.9
Teflon	2.1	79.677
Paper	3.0	66.662
Foam	4.6	53.835

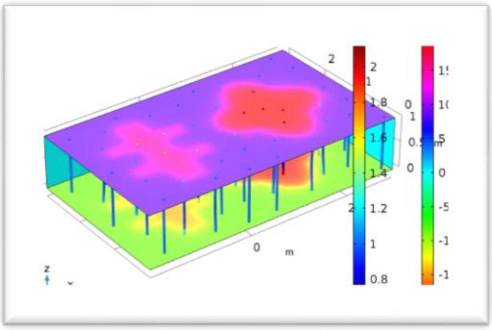
$$Z_{0,\text{analytic}} = \frac{1}{2\pi}\sqrt{\frac{\mu_0}{\varepsilon_r\varepsilon_0}}\log\left(\frac{r_o}{r_i}\right)$$



3. Simulation of Electric sensors for water purification using MEMS Comsol Multiphysics.

STUDENT OWN EXECUTED PROJECT





$$-(\varepsilon_0 \varepsilon_r \nabla V) = \rho$$

ABSTRACT:

Purifying water may reduce the concentration of particulate matter including suspendedparticles, parasites, bacteria, algae, viruses, fungi, as well as reducing the concentration of a range of dissolved and particulate matter.The standards for drinking water quality are typically set by governments or by international standards. These standards usually include minimum and maximum concentrations of contaminants, depending on the intended purpose of water use.Visual inspection cannot determine if water is of appropriate quality. Simple procedures

such as boiling or the use of a household activated carbon filter are not sufficient for treating all the possible contaminants that may be present in water from an unknown source. Even natural

spring water – considered safe for all practical purposes in the 19th century – must now be tested before determining what kind of treatment, if any, is needed. Chemical and microbiological analysis, while expensive, are the only way to obtain the information necessary for deciding on the appropriate method of purification.