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Research Paper

A Review on Vibration Based Piezoelectric Energy Harvesters

K.R. Rashmi[1*], A. Jayarama[1], N. Navin Bappalige[1] and R. Pinto[2]
[1] Physics Dept., Sahyadri College of Engineering & Management, Adyar, Mangalore-575007
[2] E & C Dept., Sahyadri College of Engineering & Management, Adyar, Mangalore-575007
*Email: rashmi.kr988@gmail.com

Abstract

This article reviews the mechanics of energy harvesting from various mechanical vibrations. Contemporary approach in hand-held electronic gadgets and low power sensors for wireless networks require a continuous or long battery life for uninturupted performance. Hence, there is a need for permanent and compact power supplies for advanced electronic devices. The most important part of the transducer is energy harvester which converts mechanical vibrations into electrical energy. Piezoelectric materials are important for energy conversion from mechanical vibrations. There has been a lot of research work to establish simple, clean and energy-efficient vibration-harvesting devices using piezoelectric materials. These piezoelectric substances are generally classified into piezoelectric ceramics and piezoelectric polymers. This review article discusses various piezoelectric materials and reviews some important device configurations for piezo-electric energy harvesters.

Keywords:piezo electrics, energy harvesters, piezo-electric polymers, cantilevers.

1 Introduction

Energy harvesting is a technique of extracting energy from various environmental energy sources such as ambient vibrations and motion of biological systems. The various environmental energy sources which are usable for harvesting small amount of energy for portable devices are ambient radio frequency, ambient light (artificial and natural light for photovoltaics), mechanical sources and thermal sources. Energy harvesting is also called as power harvesting or energy scavenging. With current advances in smart systems such as wireless sensors etc, the need for portable devices and wireless sensors is growing rapidly. Since these devices are portable, it is desirable that they are self-powered. Currently, in most cases the portable smart systems are powered by batteries. Batteries are generally undesirable because of the need for recharging or replacement. Therefore, considerable research effort has been directed for technology in energy harvesting for the evolution of self-powered sources for portable devices and wireless sensor system.

Microscale energy harvesting technology is targeted as the substitute for the conventional battery, and is based primarily on mechanical vibrations. In addition, most of these devices lack the energy source to be able to operate both indoors and outdoors, largely unaffected by ambient conditions of temperature and humidity. In this regard, vibrations associated with the body motions become attractive energy options for self-powering small electronic devices.

There are diverse mechanisms to convert mechanical energy from vibrating or moving objects into electricity needed by electronic devices, which include electromagnetic induction, electrostatic storage, and piezoelectric generation. Compared to electrostatic and electromagnetic methods, energy collection with piezoelectric materials provides relatively higher energy efficiency, and most importantly, better flexibility in portable electronic systems. Since piezoelectric material can change mechanical vibrations into electricity with very elementary structures, piezoelectric power conversions for portable systems such as wireless sensor networks are significant [1,2]. Further, while electromagnetic (EM) generators are suitable for generating energy at high frequencies, piezoelectric harvesters can give better performance than electromagnetic generators at relatively low frequencies. In addition, the volume occupied by the piezoelectric harvester is smaller than that of the EM generators for a given power density. Hence, piezoelectric transformation is a superior choice to yield energy at frequencies in the range 100-1000 Hz.

Piezoelectricity represents generation of charge or voltage in a piezoelectric material with the application of pressure. When a time alternating pressure is applied, then a time varying voltage will be generated at the two opposite surfaces of the piezoelectric material. Certain crystalline materials like tourmaline, quartz, Rochelle salt, and barium

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Research Paper

An Ethanol Sensor Review: Materials, Techniques and Performance

Charishma[1]*, A. Jayarama[2], V. Veena Devi Shastrimath[1] and R. Pinto [3]
[1] E & C Dept., Nitte Mahalinga Adyanthaya Memorial Institute of Technology, Nitte, Karkala-574110
[2] Physics Dept., Sahyadri College of Engineering & Management, Adyar, Mangalore-575007
[3] E & C Dept., Sahyadri College of Engineering & Management, Adyar, Mangalore-575007
*Email: shettycharishma@nitte.edu.in

Abstract

Sensing and detection of ethanol is essential for a various applications which include production of ethanol, fuel processing, chemical processing in industry, traffic management and societal applications. The advancement of nanotechnology has created huge potential to develop highly sensitive, portable, low cost sensors with low power consumption. A large number of materials and processes have been studied for the development of ethanol sensors. The large surface-to-volume ratio of nanostructures and nanomaterials is ideal for the adsorption of ethanol molecules. The advent of carbon nanotubes (CNTs) in particular, has advanced the development of gas sensors that exploit unique morphology, geometry, and material properties of CNTs. This review article focuses on the various methods and techniques used and various fabrication technologies involved in the development of ethanol sensors, and also reviews various performance characteristics of the sensors.

Keywords:- Ethanol sensors, selectivity, sensitivity, bismuth ferrite, redox reaction, thin films, nanostructures.

1 Introduction

Harmful gases are generated by industries and numerous other sources, rapidly deteriorates the environment; this leads not only to various health issues of humans, but also causes unnatural weather changes, environmental changes and ozone depletion[1].Hence, there is an urgent need for the detection of toxic and harmful gases. During the last few years, the demand for portable gas sensors has increased tremendously to detect the gases generated by industries, automobiles and environmental pollutants, etc. Therefore, there is a requirement for the development of efficient sensors having better sensitivity, selectivity, stability and a lower operating temperature.

Among the R & D efforts in the area of vapour sensors during the last few years, the work in the area of ethanol sensors has become extremely important. Ethanol vapour sensors with high selectivity and sensitivity have important applications as a device in traffic management, controlling the process of fermentation, food package testing for safety, wine making and medical applications. Ethanol is extensively used in liquors, scientific and industrial sectors.

The oxides of semiconductors such as ZnO, SnO_2[2 – 4], Fe_2O_3[5], $CuO - SnO_2$ [5], and others have been generally utilized as an economical sensor for hazardous, toxic and flammable vapours and gases in security and automotive applications.

The interesting physical properties of perovskite materials with the formula ABO_3 have generated enormous attention, and have found applications in several technological areas [6-8]. Among the perovskites, $BiFeO_3$ (BFO) is gaining prominence since it shows multiferroic properties simultaneously exhibits ferroelectric and ferromagnetic ordering [9-10].The sensor which is operating at room temperature is reported by Palkar et al.[11],who have demonstrated the performance of high resistivity thin films of $BiFeO_3$ as an ethanol sensor at room temperature. This paper reviews materials, methods and detection techniques for ethanol sensing, fabrication techniques such as growth of thin films, sensor development and evaluation of their performance measures such as sensitivity, selectivity, response and recovery time.

2 Materials for Ethanol Sensor

There are varieties of materials used for detection of ethanol in the last few years. Most important materials used are: ZnO, Al_2O_3, Multiwalled Carbon Nano Tube (MWCNT)-doped ZnO, Indium Zinc Oxide, polyaniline (PANi) with MWCNT, magnesium ferrite, $CdIn_2O_4$ nanoparticles, vanadium pentoxide, SnO_2, Sb doped SnO_2,TiO_2-doped SnO_2, mesoporous $ZnO - SnO_2$, titanium oxide, $LaFeO_3$, bismuth ferrite and barium substituted bismuth ferrite.

The ethanol gas detecting properties for thick films of doped and pure zinc oxides were investigated by Patil et al. [5]. Screen printing techniques was utilized to prepare the thick films of pure ZnO. The effect of doping and microstructure of the film on the gas response, selectivity, response time and recovery time when exposed to ethanol vapours were studied and discussed. Pure ZnO

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Electrocatalytic reduction of CO_2 into useful chemicals-A Brief Review

M.B. Savitha[1], A. Jayarama[2] and Richard Pinto[3]

[1] Chemistry Dept., Sahyadri College of Engineering and Management, Adyar, Mangalore, 575007

[2]Physics Dept., Sahyadri College of Engineering and Management, Adyar, Mangalore, 575007

[3] E & C Dept., Sahyadri College of Engineering and Management, Adyar, Mangalore, 575007

[1]Email: savitha.chem@sahyadri.edu.in

Abstract

Electro reduction of CO_2 has become a subject of great importance over the last few decades. This is fundamentally because CO_2 is a notorious green house gas released both by artificial and natural processes. This review highlights current status and future directions in the electroreduction of CO_2 into sustainable production of useful fuels. The current trends in understanding of CO_2 reduction process and the pathways through which various products are formed are discussed. Electro Catalysts play a very important role in the CO_2 reduction process to generate low-carbon fuels, including CO, $HCOOH/HCOO^-$, CH_2O, $H_2C_2O_4/HC_2O_{4^-}$, C_2H_4, CH_{4^-}, CH_3OH, CH_3CH_2OH and others. The electro-catalysts can be classified into several types, which include metals, metal oxides, metal alloys, metal complexes, polymers/organic molecules and others. The vital characteristics of electro-catalysts which include product selectivity, activity, Faradaic efficiency and catalytic stability have been discussed in detail. The experimental evidence available so far indicates copper is the best catalyst for electroreduction of CO_2 into hydrocarbons. In particular, recent developments showing high selectivity and faradaic efficiency for generation of ethanol in oxygen derived copper nanoparticles as well as copper nanoparticles supported on carbon nano-spikes are extremely interesting. The review also presents basic aspects of electrochemical cell for the electroreduction of CO_2. Finally, the demonstration of feasibility of a two step CO_2 conversion into liquid fuels and the challenges in developing highly active and stable electro-catalysts for reduction of CO_2 are discussed, indicating directions for future research and development in this very important area.

Keywords: CO_2 conversion, CO_2 reduction, Copper, Ethanol, electro-catalysis, Reaction mechanism.

1 Introduction

The electrocatalytic conversion of carbon dioxide (CO_2) into useful chemicals has attracted many researchers worldwide for decades as it can enable a sustainable low temperature redox cycle for energy conversion and storage [1, 2]. While CO_2 is an essential substance for the growth of all plants and for numerous industrial processes, it has now become a significant greenhouse gas due to both natural and manmade processes [3-6]. In an ideal situation, CO_2 consumed should be balanced with what is produced on Earth, so that the level of CO_2 remains constant to maintain environmental stability. However, increased human industrial activities and consumption of fossil fuels has caused imbalance in CO_2 concentration in the environment and has made global warming an urgent issue. Hence, reduction of CO_2 production and conversion of excess CO_2 into useful chemicals is critical, for environmental protection. Therefore, various governments all over the world have shown concern by increasing their funding for research to address the CO_2 issue. Hence, electrochemical reduction of CO_2 into useful products and chemicals is urgently needed [7,8]. However, Carbon dioxide (CO_2) produced by most hydrocarbon feedstock combustion processes is a thermodynamically stable product [9] and hence, reduction of CO_2 is challenging.

During the last 30 years a great deal of research effort has been directed in the electrochemical reduction of CO_2. Electrochemical conversion of CO_2 into hydrocarbons was reported in 1985 by Hori et al. using cathode materials such as Cd, In, Sn and Pb which predominantly gave formate and small amount of CO, CH_4 and H_2. More importantly, they reported the production of CH_4 on pure copper as a cathode for the first time [10]. In 1986, the same authors reported the production of CH_4 and C_2H_4 by electrochemical

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Research Paper

Design and simulation of MEMS P(VDF-TrFE) cantilevers

Rashmi[1*], Niraj Joshi[2], N. Navin Bappalige[1], A. Jayarama[1] and R. Pinto[2]
[1]Physics Dept., Sahyadri College of Engineering & Management, Adyar, Mangalore-575007
[2]ECE Dept., Sahyadri College of Engineering & Management, Adyar, Mangalore-575007
*Email: rashmi.kr.988@gmail.com

Abstract

This paper presents design and simulation of micro-electromechanical systems (MEMS) based piezoelectric cantilevers and beams. Poly (vinylidine fluoride-trifluoroethylene) (P (VDF-TrFE)) co-polymer was chosen as the piezoelectric material which has better piezoelectric properties than other polymers. These piezoelectric co-polymer cantilevers form the main elements as low level and low frequency energy harvesters or vibration sensors. P (VDF-TrFE) cantilevers and beams were designed to take advantage of unimorph d_{33} mode. The design has an active P(VDF-TrFE) layer, Cr/Au electrode of interdigitated pattern for power/signal output. The design is to be implemented on 2 inch diameter, <110> silicon base, bulk micro-machined using TMAH etchant. P(VDF-TrFE) cantilevers and beams were simulated using Comsol Multiphysics simulation software with dimensions in the range 100-400μm width, Length 200-2000μm and all having thickness of 2.5μm. The mechanical and electrical properties of cantilevers were analyzed during the simulation. The results show that the fundamental resonance frequency varied from 6.483 kHz for 100 (W) x 200 (L) μm^2 to 63.328 Hz for 400 (W) x 2000 (L) μm^2 cantilevers. Similarly, the fundamental resonance frequency varied from 41.98 kHz for 100 (W) x 2000 (L) μm^2 to 410.76 Hz for 400 (W) x 2000 (L) μm^2 for beams. Hence, it is clear from the simulation results that, as the length of cantilever/beams increases fundamental resonance frequency decreases.

Keywords: Microelectromechanical systems, P(VDF-TrFE) cantilevers, beams, energy harvesters, vibration.

1 Introduction

With the advancement of technology in electronic systems such as wireless sensors, mobile phones, external wearable medical devices etc, researchers have focused on advancement of smaller volume and durable power sources. Batteries as a conventional power sources have some limitations due to its higher volume and a limited lifetime [1, 2]. To reduce the energy sources issue, energy harvesting is an attractive way to extract energy from environmental renewable energy sources such as solar, wind, tidal and geothermal [3]. Furthermore, ambient mechanical vibration can be recycled to generate electrical energy for wireless sensor networks, chemical sensors [4] and health monitoring [5]. Vibration based energy harvesters efficiently convert vibration energy into electrical energy using three electromechanical transduction processes: electrostatic, electromagnetic, and piezoelectric [6-8]. Among those transduction methods, piezoelectric transducers have attained much attention due to the simplicity in configuration and higher conversion efficiency [9, 10].

In piezoelectric transduction there are some piezoelectric materials namely, Lead Zirconate Titanate (PZT), Polyvinylidene Fluoride (PVDF) and their co-polymers [11], and Aluminium nitride (AlN) [6]. When those piezoelectric materials are configured for mechanical energy, then electrical energy will be generated and vice versa as shown in Figure 1 [12].

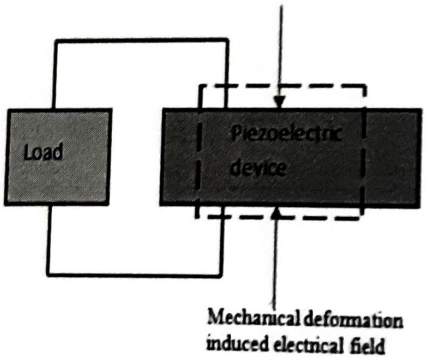

Figure 1: Piezoelectric effect of piezoelectric materials.

Ambient mechanical vibration sources generally provide lower frequencies (< 1000 Hz); in order to utilize ambient vibration properly, resonant frequency of piezoelectric energy harvester should be in the range of vibration. Moreover, maximum energy can be harvested efficiently when energy harvester is driven at the resonant frequency [13]. However, there is a limited choice

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Comparative Study on Capacitive Pressure Sensor for Structural Health Monitoring Applications

Shivaleela.G[1], Dr. Praveen. J[2], Dr. Manjunatha. DV[3], Dr. Habibuddin Shaik[4]

P.G. Student, Department of Electronics &Communication Engineering, Alva's Institute of Engg. &Technology, Mijar, Moodbidri, Karnataka, India[1]

Dean Academic, Department of Electronics and Communication Engineering, Alva's Institute of Engg. & Technology, Mijar, Moodbidri, Karnataka, India[2]

HOD, Department of Electronics and Communication Engineering, Alva's Institute of Engg. & Technology, Mijar, Moodbidri, Karnataka, India[3]

Assistant Professor, Department of Physics, Nitte Meenakshi Institute of Technology, yelahanka, Bangalore, Karnataka, India[4]

ABSTRACT:This paper is mainly focuses on the development of a capacitive pressure sensor device for structural health monitoring applications for higher sensitivity. One amongst the strategies to measure vibrations is to mount a pressure sensor on the vibratory machinery or object and measure the pressure exerted owing to vibrations. Therefore this measured physical phenomenon's helps us to notice any deviations from the conventional conditions. The MEMS based capacitive pressure sensors are gained plenty of attention within the market owing to its advantage over MEMS based piezoresistive pressure sensors like low power consumption, high sensitivity, IC compatibility, free from a temperature effects, etc. In this work, the MEMS based capacitive pressure sensor having a versatile square diaphragm of length 10,000µm × 10,000µm with thickness of 525µm using 1-spring, 4-springs and 9-springs at each corner is designed and simulated using Finite Element Method (FEM) with minimum element size of 1.5µm. Also the comparisons between the same three models are done in order to analyze the better sensitivities among them. The typical external pressure ranges between 1Pa to 10,000Pa is applied on the flexible diaphragm. The simulation analysis of mechanical and electrical behavior of the capacitive pressure sensor is done using MEMS CAD tool as COMSOL MULTIPHYSICS. During Comsol Multiphysics analysis, a displacement of 1.57e-4µm at 1Pa pressure and capacitance sensitivity of 5.12e-14F/Pa was observed for 9-springs capacitance pressure sensor which is a better sensitivity as compared to 1-spring and 4-springs capacitive pressure sensor.

KEYWORDS:MEMS, Capacitive Pressure Sensor, springs, Sensitivity, Comsol Multiphysics.

I. INTRODUCTION

Nowadays MEMS based mostly pressure sensor device has gained tremendous benefits like low power consumption, high sensitivity, low-cost, etc. Hence it is necessary to understand the precise definition of MEMS and its types. Micro-Electro Mechanical Systems (MEMS) is a technology that shows evident exponential growth from last two decades in terms of device miniaturization as its feature size varies in micrometer range. MEMS devices has several applications within the field of bio-medical, automobile, microphones, communication, smart systems, underground

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Comparative Study on Capacitive Pressure Sensor for Structural Health Monitoring Applications with Coventorware

Shivaleela.G[1], Dr. Praveen.J[2], Mahendra.HN[3], Nithya G[4]

[1]*M.Tech Student, Dept. of Electronics and Communication Engineering, Alva's Institute of Engg. & Technology, Mijar, Moodbidri, Karnataka, India*

[2]*Dean Academic, Dept. of Electronics and communication Engineering, Alva's Institute of Engg. & Technology, Mijar, Moodbidri, Karnataka, India*

[3]*Assistant professor, Dept. of Electronics and Communication Engineering, Alva's Institute of Engg. & Technology, Mijar, Moodbidri, Karnataka, India*

[4]*JRF, Center for Nanomaterials & MEMS Center, Nitte Meenakshi Institute of Technology, yelahanka, Bangalore, Karnataka, India*

Abstract - *This paper is mainly focuses on the design and simulation of capacitive pressure sensor device for structural health monitoring applications using COVENTOWARE to obtain high sensitivity. MEMS based sensor has gained more attention in many fields such as automotive, industrial and biomedical applications. The capacitive pressure sensor has its advantage over MEMS based piezoresistive pressure sensors such as low power consumption, high sensitivity, IC compatibility, free from a temperature effects, etc. In this proposed work, the MEMS based capacitive pressure sensor using 1-spring, 4-springs and 9-springs has been designed having a square diaphragm of length 10,000μm × 10,000μm and thickness of 525μm using Finite Element Method (FEM) and the models are implemented using POLYMUMPs process flow. The design is analyzed for applied pressure of 1Pa on the square diaphragm. The simulation analysis of the capacitive pressure sensor is done using COVENTORWARE TURBO 2010.*

***Key Words*: MEMS, Sensitivity, Capacitive pressure sensor, POLYMUMPs, COVENTORWARE**

1. INTRODUCTION

Micro-Electro Mechanical Systems (MEMS) is a technology that shows evident exponential growth from last two decades in terms of device miniaturization as its feature size varies in micrometer range. A MEMS device has a many applications in the field of automobiles, Bio-medicals, microphones, communication, smart systems, underground oil explorations etc. [1]. Due to the recent development in the micro-scale fabrication technology, MEMS based pressure sensors are being fictitious for the pressure levels ranges from ultra-low to extraordinarily high. There are different kinds of MEMS pressure sensor devices such as capacitive sensor, piezoelectric sensor, piezoresistive sensor etc. The piezoresistive type of sensors is considered as the first micro-machined sensor that yields to be mass created. The piezoresistive pressure sensors are extremely temperature sensitive and high power consumption; hence they are not used for higher temperature applications [3]. The capacitive pressure sensor is mainly gained attention for measuring of each absolute and differential pressure. They also have the advantage of high pressure sensitivity, low power consumption, less elementary noise floor and low temperature sensitivity. Additionally to those, it has high frequency permeability, compactness, low cost, ease to fabricate, smaller volume and high resolution [1].

In general, MEMS capacitive pressure sensors are constructed using two parallel plates during which the upper plate consists of a thin flexible membrane called as diaphragm and therefore the lower plate is fixed or vice versa. These two parallel plates are separated by a dielectric material such as vacuum or air. Once the external pressure is applied on the diaphragm membrane, it displaces the diaphragm thereby change in the gap between the two plates takes place, thus the capacitance is also changes [2]. The sensitivity of the capacitive sensors are directly depends upon the materials and structures used.

1.1 Literature Review

In [3], the author have been designed the Square diaphragm pressure sensor with length 1500μm ×1500μm and separation gap between the top and bottom diaphragm was 196μm was demonstrated. The thickness of the diaphragm was 4μm with a center boss structure of diameter 150μm and thickness of 1μm. The uniform pressure ranges from 10 kPa to 120 kPa had been applied on the diaphragm. The deflection sensitivities observed for the given range for normal diaphragm and bossed diaphragm was 2.02μm/kPa and 2.94μm/kPa. The design analysis is done using Comsol Multiphysics tool, that involves simulation results and performance analysis of MEMS based capacitive pressure sensor using springs with square diaphragm. In [6], the authors have designed and analyzed the perforated MEMS capacitive pressure sensor of length 50μm and gap between the plates is 3μm. The simulation is carried out using both COMSOL and Coventorware tools. The sensitivity of the model is increased with respect to increase in the applied pressure.

In the next section of the paper clearly gives the idea about a design and implementation of the capacitive pressure sensor for

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Visible Light Communication Based Information Broadcasting System

Shek Sharuk[1], Shivaraj[2], Syed Ismail Zabiulla[3], Vinaya Bhooshan R[4], Jyothi Pramal[5]
Eight Semester UG Students, Department of Electronics & Communication Engineering, AIET, Moodbidri, Karnataka, India[1-4]
Assistant Professor, Department of Electronics & Communication Engineering, AIET, Moodbidri, Karnataka, India.[5]

ABSTRACT: Optical wireless communication through visible light has been appreciably explored with the development and widespread use of white light emitting diodes (LEDs). Visible light is used as the medium for data transmission between the transmitter and receiver. Visible light communication has few advantages over other standard wireless transmissions. The frequency spectrum bandwidth of visible light ranges from 430 THz to 750 THz which is much larger than the radio frequency bandwidth, which ranges from 3 KHz to 300 GHz. With a larger bandwidth it is feasible to accommodate more users and potentially achieve higher transfer rates because each user can be given a larger portion of the bandwidth to transfer information.

This paper, demonstrates a wireless system via visible light communication (VLC) technology. The prototype demonstrates a transmission baud rate of 9600 without data loss at a distance of about 10 cm for broadcast communication system. This system is proposed to demonstrate how VLC can be used in Super Market/Shopping Malls (indoor environment) as they contain LED lights in every section. Using these LEDs, our proposed system can provide advertisements regarding offers or new arrivals in the mall through an android application to the customers. The prototype is proposed to demonstrate the working of VLC system by means of an indoor application.

KEYWORDS: Optical wireless communication, light emitting diode (LED), visible light communication (VLC), pulse width modulation (PWM).

I.INTRODUCTION

VLC is a subset of optical wireless communication technology. The technology uses fluorescent lamps (ordinary lamps, not special communications devices) to transmit signals at 10 Kbps, or Light Emitting Diode (LED) for up to 500 Mbps. VLC can be used as a communication medium for ubiquitous computing, because light-producing devices (such as indoor/outdoor lamps, TVs, traffic signs, commercial displays and car headlights/tail lights) are used everywhere. Visible light is also less dangerous for high-power applications because humans can perceive it and protects their eyes from damage.

The LED lighting system can achieve lower power consumption and has a longer life-time compared to the fluorescent lamp system. The Visible Light Communication (VLC) is a fast-growing technology to provide data communication using low-cost and omnipresent LEDs and photodiodes. In Visible Light Communication (VLC), LEDs used for illumination purpose are simultaneously used for wireless data transmission. It offers numerous advantages such as high data rates, unlicensed large bandwidth and better data security leading to smart spaces.

II.EXISTING SYSTEM

The existing system develops a basic VLC simplex peer to peer and broadcast communication system. Their system allows a 9600 data transmission rate between two end devices without data loss at a distance of 30cm for peer to peer communication system and at a distance of 10cm for broadcast communication system.

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Research Article

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Design of a Multiplier using Low Power High Speed Hybrid Full Adder

Shruthi[1], Vinutha .K. R[2], Anilkumar[3], Shiddalingesh koppal[4], Mahendra .H .N[5], Dr. Mallikarjunaswamy S[6]
UG Student[1, 2, 3, 4], Assistant Professor[5], Associate Professor[6]
Department of ECE
Alva's Institute of Engineering and Technology, Moodbidri, India[1, 2, 3, 4, 5], SJBIT, Bangalore[6]

Abstract:
In this paper, a hybrid 1-bit full adder design employing both Pass Transistor Logic (PTL) and transmission gate (TG) logic is reported. The circuit was implemented using Cadence Virtuoso tools in 180nm technology. Performance parameters such as power and delay were compared with the existing designs such as complementary pass-transistor logic, transmission gate adder, transmission function adder, hybrid full adder. For 1.8-V supply at 180-nm technology, the average power consumption and delay of the proposed adder was found to be 26.68µW and 3.55ps. The design was further implementing on 2*2 Braun multiplier. When compared with the present full adder styles, this implementation was found to supply vital improvement in terms of power and speed.

Index terms: Braun multiplier, highspeed, hybrid design, lowpower.

I. INTRODUCTION

Increased usage of battery operated transportable devices like cellular phones, personal digital assistants (PDAs), and notebooks demand VLSI, associated ultra large scale integration style with an improved power delay characteristics. Full adders are the essential building block of these devices Different logic designs is accustomed to design a 1-bit full adder cell. Design is broadly classified into two categories, they are:1) static vogue and 2) dynamic vogue. Static full adders usually has lot of reliability, less complicated with less power demand, however the on chip space demand is sometimes larger compared with its dynamic counterpart. Different logic style tends to offer one performance facet at the expense of others. Standard static Complementary Metal–Oxide–Semiconductor (CMOS), dynamic CMOS logic, complementary pass-transistor logic (CPL) and transmission Gate Full Adder (TGA) are the foremost vital logic style design within the standard domain. The combination of any two logic design is called as Hybrid logic style. This style exploits the options of various logic designs to boost the performance of the adder [1]. Each logic style has its own advantages and disadvantages. Standard static CMOS full adder is based on regular CMOS structure with pull-up and pull-down transistors, this adder provides full output voltage swing against voltage and transistor sizing. The limitations of this design are its lager area and slower speed due to the availability of PMOS devices and larger input capacitance of the static CMOS logic gates. Complementary Pass Transistor (CPL) is fast and provides full voltage swing output. CPL adder requires 32 transistors but it has larger power consumption because of the presence of static inverter and lot of internal nodes. Another logic style of designing an adder is hybrid logic style. These adders are designed with the combination of more than one logic style to enhance the overall performance of the system. The main focus of the hybrid logic style is to reduce the number of transistors and power dissipation nodes of the adder cell [2].

II. COMPARATIVE ANALYSIS OF DIFFERENT TYPES OF FULL ADDER CIRCUITS

Several logic designs reutilized in the past to design a full adder cell. Every logic style has its own benefits and bottlenecks.

A. Conventional CMOS Full Adder

A classical design of standard static CMOS full adder relies on regular CMOS structure with pull-up and pull-down transistors. Complementary transistor pairs build the circuit layout easy. CCMOS generates carry through a static gate. The benefits of using CCMOS is that it's layout regularity, high noise margin and stability at low voltage attributable to complementary transistor pair and smaller number of interconnecting wires. The disadvantages is that it uses c_{out} signals to generate sum which produces an unwanted extra delay. It has weak output driving capability due to series transistor in output stage and consumes additional power and huge silicon area. The circuit is shown in Fig.1

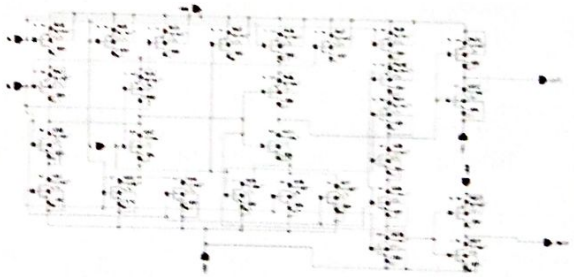

Figure.1. CCMOS schematic diagram

B. Complementary Pass Transistor Logic

The basic difference between the Pass Transistor Logic (PTL) and Complementary CMOS logic style is the source side of the pass transistor logic network is connected to some input signal instead of power lines. It uses 32 transistors which is shown in

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Adventitious signal identification and estimation of alveolar exudates

Shankar B. Bandiwaddar[1], Dr. D Jayadevappa[2]

[1]*Research Scholar*
Jain University, Bangalore, India

[2]*Professor*
Dept. of IT, JSSATE, Bangalore, India

Abstract: Exudates are unwanted lipids propagated by blood vessel. Identification and estimation of exudates in bronchioles through the use of image processing techniques is addressed in this paper. This provides significant information that allows for an accurate diagnosis, registration, classification and visualization of bronchioles generating adventitious sound. Identifying and counting exudates of asthmatic bronchiole is carried out by image processing techniques. Simultaneously the the adventitious sound produced by the exudates is analyzed by Hilbert Huang Transform (HHT). Various morphological filtering operations are carried out on the alveolar images to segregate exudates and quantify their strength. The blobs in the spectrogram and the frequencies emphasized in HHT indicate the presence of exudates in the alveoli. HHT is very useful to analyze nonlinear and nonstationary abnormal lung sounds like crackles. Finally the first Intrinsic Mode Function (IMF) of Empirical mode decomposition (EMD) from thus obtained sound wave from alveolar exudates is plotted.

Keywords: Exudates; edge detection; alveoli; crackle;

I. Introduction

Wheezing is a chronic disease that produces adventitious sounds that is the result of a clinical expression of a lower airway obstruction and usually it is reversible. Alveolar hyper responsiveness is recorded by decreased alveolar airflow after broncho provocation. Wet air, heavy workout, viral upper respiratory infection, the smoke of cigarette and lung allergens inside and outside the house triggers and it provoke airway obstruction [1]. The main factor to develop exudates is a loss of the ciliated respiratory epithelium and the transudation of oedema fluid into the bronchial lumen. The shedding of the bronchial mucosa or in the pathogenesis of the asthmatic attack is a characteristic feature of bronchospasm [2]. Bronchioles become obstructed by organizing exudate and polypoid masses and thus determine the adventitious sound of wheezes. Specialized imaging algorithms are used to estimate the site of pulmonary emphysema in a simulation study[3]. Utmost priority must be taken to recognize exudates in alveoli to take care of public health issue and to improve management strategies like early recognition of symptoms thereby reducing the number of deaths due to exudates in alveoli. Hilbert-Huang Transform (HHT) is an excellent method for analysis of crackles, a nonlinear and nonstationary data that developed by Huang et al [6].

II. METHODS

Exudates are detected from the alveolar image using edge detection and feature estimation techniques. Exudates are brilliant lipids spilled from a vein. The replaced liquid has a tendency to remain nearby to the injury, giving the most part is characterization features.

Exudates detection in alveoli involves the following steps :

- Pre-processing an alveolar image.
- Eliminating the outer border.
- Determining circular border of an image.
- Estimating the blood vessels in an image.
- Final recognition.

A binary image containing true and false exudates are determined. Binary image removes blood vessels. After completion of pre processing, the rectangular border on an image is removed. The undesired regions like the border of the image is grouped into a logical array, which converts numeric values to logical. The next step is the detection of blood vessels. Image filtering function extracts the blood vessels and blood

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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
[3]Asst. Professor Dept. of Electronics and Communication. AIET Moodbidri 574225
[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.

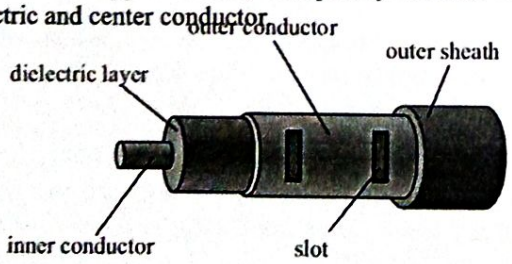

Fig 1: Coax Cable outlook.

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

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FPGA IMPLEMENTATION OF SUM OF ABSOLUTE DIFFERENCE (SAD) FOR VIDEO APPLICATIONS

D. V. Manjunatha[1], Pradeep Kumar[1] and R. Karthik[2]
[1]Department of Electrical and Computer Engineering, Alvas Institute of Engineering and Technology, Moodbidri, India
[2]Department of Electrical and Computer Engineering, MLR Institute of Technology, Hyderabad, India
E-Mail: dvmanjunatha@gmail.com

ABSTRACT

Advances in multimedia have expanded the boundaries of communication systems and changed the communication industry over the past a few decades in the applications such as digital TV, DVD video, HDTV, internet video streaming, video conferencing, mobile technology, patrolling, object tracking, and medical applications. Video compression (VC) placed a significant part in the realization of these technologies by bridging the gap between the demand for quality, performance and limitations of current storage and transmission capabilities. Motion estimation (ME) is the power hungry block in the video compression system (VCS). The sum of absolute difference (SAD) is the most repeated operation in the motion estimation subsystem. This paper proposed the field programmable gate array (FPGA) Implementation of 4X4 SAD architecture. The design is simulated using Xilinx integrated software environment (ISE) and synthesized using Xilinx synthesis tool (XST) on Spartan-3 FPGA board. The proposed SAD estimates area acquired and latency.

Keywords: VC, ME, VCS, SAD, FPGA, ISE, XST.

1. INTRODUCTION

Video compression systems are very helpful in commercial products, from consumer electronic devices as digital camcorders, cellular phones to video teleconferencing systems. Block Based motion estimation searches for the best matching block between the current and reference macro blocks (MBs), for the operation, the sum of absolute difference is one of the most frequent employed criteria as a result, motion estimation produces a motion vector , which represents the motion of the macro block. Sum of absolute difference is an algorithm for measuring the similarity between the image blocks. It works by taking the absolute difference between each pixel in the original block and the corresponding pixel in the block being used for comparison. These differences are summed to create a simple metric of block similarity. For example the sum of absolute differences to identify which part of a search image is most similar to a template image. In the example, the template image is 3 by 3 pixels in size, while the search image is 3 by 5 pixels in size. Each pixel is represented by a single integer from 0 to 9. The template and the search image pixel values are as shown in Table-1. There are exactly three unique locations within the search image where the template may fit: the left side of the image, the centre of the image, and the right side of the image. To calculate the SAD values, the absolute value of the difference between each corresponding pair of pixels is used: the difference between 2 and 2 is 0, 4 and 1 is 3, 7 and 8 is 1, and so forth.

Table-1. Pixel values of the image / frame.

Template image	Search image
2 5 5	2 7 5 8 6
4 0 7	1 7 4 2 7
7 5 9	8 4 6 8 5

Calculation of SAD values for each of these locations is given below:

Table-2. Absolute difference values of three images.

Left	Centre	Right
0 2 0	5 0 3	3 3 1
3 7 3	3 4 5	0 2 0
1 1 3	3 1 1	1 3 4

For each of these three image patches, the absolute differences are added together, giving a SAD value of 20, 25, and 17, respectively, from these SAD values, it is apparent that the right side of the search image is the most similar to the template image, because it has the least difference as compared to the other locations. The rest of the paper is organized as follows: Section 2 describes the related work in the sum of absolute differences as a metric of motion estimation to find the motion vectors. Proposed adder architecture is described in section3. Section 4 gives the details sum absolute difference architecture. Section 5 describes the results and discussion, finally we conclude in section 6.

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Estimation of Ensembles in an Adventitious Wave by EMD and EEMD Techniques

Shankar B. Bandiwaddar [1], Dr. D Jayadevappa [2]
[1]Research Scholar, Jain University, Bangalore, India
[2]Professor, Dept. of IT, JSSATE, Bangalore, India

Abstract:- The Empirical Mode Decomposition (EMD) is a basic building block of Hilbert-Huang Transformation. The main principle behind EMD is to decompose a sound wave into its intrinsic mode function (IMF). The time domain analysis is fairly described with EMD breaking down. The basis is derived from the same sound wave only. The analysis is useful for affected respiratory sound waves, which are non-linear and non-stationary in nature. Huang and Wu established another milestone in the area of EMD called Ensemble Empirical Mode Decomposition (EEMD). The EEMD is now can be used to interpolate a sound wave from the affected waveform. The EEMD specify a certain TRUE IMF components as an ensemble mean, every component consists of a sound wave in addition to Gaussian Noise of certain amplitude. In this paper, the mean and standard deviation at a different instance of the affected wheezing respiratory wave is discussed. The comparison between crackle wave and the wheezing wave is listed with respect to mean and standard deviation. The results specified in the table shows that the EEMD is an efficient technique for minimizing noise affected with abnormal lung waves.

Keywords:- CAS, DAS, EEMD, EMD, EXTREMA, MINIMA.

I. INTRODUCTION

Analysing and estimating a wheezing sound wave that is degraded by additive Gaussian noise is a primary problem in signal analysis. Usually, sound wave denoising is used to achieve the estimates of the crackle and wheezing waves which are discontinuous adventitious sounds (DAS) and continuous adventitious sounds (CAS) respectively. The estimated signal must be much closer to normal breathing sound wave while retaining the very fine details. Many methods for estimation of the affected adventitious wave have been reported in the survey ranging from linear to nonlinear methodologies. Wiener filter and wavelet transform thresholding techniques are one among them [1]. However, the wavelet transforms based denoising exhibits problem in selecting the wavelet base, threshold function, and its value. In order to minimize these limitations, Huang experimented EMD and Huang and Wu established a new era in EMD by formulating Ensemble EMD. The overall analysis achieves the higher ranking in order to analyse the non-linear and non-stationary wheezing respiratory sound waves.

II. PROPOSED WORK

The two different decomposition techniques are proposed to nullify the noise and to detect the number of ensembles present in the adventitious wave.

A. Empirical Mode Decomposition

The Empirical Mode Decomposition is a basic building block of the Hilbert–Huang transform (HHT) [5]. The HHT can be used to acquire instantaneous frequency spectrum of non-linear and non-stationary adventitious sound waves. These waveforms can also analyse with the help of empirical mode decomposition. The major benefit of EMD is that it is completely due to adventitious wave information itself. The main role of EMD is to decompose an adventitious sound wave into its intrinsic mode function (IMF). Compare to wavelet transformation, the EMD is a superior analysis technique, in which fundamental functions are fixed and thus matching of the real wheezing waves not compulsory[2]. If the following functions are satisfied then it is called an IMF of adventitious [7].

- In the entire adventitious sound wave, the total number of extrema and the number of baseline crossings must be same or vary at the most by single variation.
- At any adventitious sound wave, the mean is represented by the local maxima and its envelope represented by the local minima is zero.
- The method of identifying an IMF is called sifting.