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Impact of AlInN Back-Barrier Over AlGaN/GaN MOS-HEMT With HfO_2 Dielectric Using Cubic Spline Interpolation Technique

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***Abstract*— The dc characteristics of AlGaN/gallium nitride (GaN) metal–oxide–semiconductor-high electron mobility transistor (MOS-HEMT) with an AlInN back-barrier layer has been studied here. An analytical model is proposed for evaluating the charge density (σ_{tot}), carrier concentration (n_S), drain current (I_D), and transconductance (g_m) of the device by incorporating Hafnium oxide (HfO_2) as a high-*k* dielectric layer. The charges created between the oxide and the AlGaN barrier layer influence the enhancement of carrier concentration of up to 6.2×10^{13} cm^{-2}, at the two-dimensional electron gas (2DEG). The AlInN back-barrier increases the conduction band (CB) level of the GaN buffer and eliminates the confinement problems near the channel. By deriving the mathematical dependence of these parameters, this device demonstrated a positive threshold shift and a high current drive of 880 mA/mm. Cubic spline interpolation (CSI) technique is employed here to model the parameters in a more precise manner. The outcomes are evidence that the device could be a potential solution for high power switching as well as microwave applications.**

***Index Terms*— AlGaN/gallium nitride (GaN), AlInN, back-barrier, cubic spline interpolation (CSI), HfO_2 dielectric, metal–oxide–semiconductor-high electron mobility transistor (MOS-HEMT).**

I. Introduction

SILICON is one of the most common and significant semiconductor materials used in the industry. A remarkable quantity of the research carried out in semiconductors constitute of silicon-based devices. There have been some analytical research carried out for low-dimension silicon-based devices at nanoscales [1], [2]. However, silicon material poses a menace to the microelectronics revolution by keeping the device from performing at high frequencies while scaling down further. Low-dimensional devices find it a challenge to function at high frequencies. So, attention turns over to a more diverse group of materials that approaches the problem of group III–V semiconductors [3]. Significant research was carried out by evaluating the performance metrics of group III and V metal–oxide–semiconductor field effect transistors (MOSFETs) using materials for high electron mobility channels and gate oxides [4]. Gallium nitride (GaN)-based materials were used for building transistors with high mobility, such as high electron mobility transistor (HEMT), achieving large breakdown voltages and suitable for RF circuit simulation and high frequency applications [5], [6].

AlGaN/GaN-based HEMTs have found intense popularity in the early years due to its capability to form polarization induced charge densities in the order of 10^{13} cm^{-2} inside the triangular potential well [7]. AlGaN/GaN heterostructures also displayed excellent breakdown characteristics proving themselves a viable contender for switching power devices [8], [9]. AlInN material is used as a back-barrier since it could prevent the forming of parasitic electron channel in the buffer layer due to its negative polarization charge [10]. There was still an issue of large gate leakage currents occurring in HEMT devices. Metal–oxide–semiconductor-HEMT (MOS-HEMT) devices were used to overcome this issue by incorporating an oxide or dielectric layer near the metal region. Early research carried out in AlGaN/GaN-based MOS-HEMTs incorporated Silicon dioxide (SiO_2) as the dielectric [11], [12]. AlGaN/GaN hetero-structures were later characterized with oxide layers having high dielectric constants like zinc oxide (ZnO) and aluminum oxide (Al_2O_3) and produced exceptional RF and dc performances than the HEMT [13], [14]. HfO_2 is one among such high-*k* dielectric materials having a large dielectric constant and bandgap. Not only does it enhance the polarization charges and the oxide/GaN interface traps, it also creates a positive threshold shift and the oxide defect charge [15].

In this work, an AlInN material is employed as a back-barrier layer, which eliminates some of the parasitic

Manuscript received June 28, 2020; accepted July 16, 2020. Date of publication August 5, 2020; date of current version August 21, 2020. The review of this article was arranged by Editor K. Alam. *(Corresponding author: J. Charles Pravin.)*

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Color versions of one or more of the figures in this article are available online at http://ieeexplore.ieee.org.

Digital Object Identifier 10.1109/TED.2020.3010710

Silicon
https://doi.org/10.1007/s12633-020-00647-3

ORIGINAL PAPER

A Numerical Investigation of Heat Suppression in HEMT for Power Electronics Application

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Received: 2 June 2020 / Accepted: 10 August 2020

Abstract
In this paper, AlGaN/GaN High Electron Mobility Transistor (HEMT) with stacked passivation (Diamond/SiN) is proposed and investigated. The implementation of stacked passivation in HEMT has been shown to be effective in suppressing self-heating effect. Under the gate-terminal, the peak channel temperature of HEMT with stacked passivation is 384 K, whereas it is 393 K for conventional HEMT. The reduction of channel temperature in the proposed device is attributed to good heat-spreading via diamond. The thermal resistance (R_{TH}) is extracted and it is found that R_{TH} of proposed HEMT is 17% lower than that of the conventional HEMT. The transconductance of the proposed GaN-HEMT is also improved by 12%. Furthermore, the maximum drain current of 800 mA/mm at $V_{GS} = 0$ V and $V_{DS} = 5$ V is obtained for the proposed HEMT with a gate length of 0.25 μm. The proposed device is considered as one of the most attractive candidates for future high frequency and high-power applications over a wide range of operating temperatures.

Keywords GaN · HEMT · Self-heating · Diamond · Therma resistance

1 Introduction

In recent years, AlGaN/GaN-on-SiC HEMT receives a great attention in power amplifier and power switches due to their capability of delivering high power at high-frequency [1–3]. Technology innovations such as field plate engineering, back-barrier under GaN buffer and gate-length reduction further enhances the RF and DC performance of GaN HEMT. The performance metrics are breakdown voltage [4–6], drain current [7–9], output-power [10–13], unity current-gain cut-off frequency (f_T) [14], maximum oscillation frequency (f_{MAX}) etc. However, the improvement in these performance metrics increase the acceleration/velocity of electron in the channel under gate edge of the device. This results in increase of thermal resistance, reduction of total safe operating area, and increase of channel temperature in the device [15]. Thermal failure and threshold failure levels in semiconductor device also occurs due to increased channel temperature. The increase in channel temperature results in self-heating effects which is a serious concern in modern AlGaN/GaN HEMT and an extensive investigation is required in this case. A continuous effort has been made to model and/or characterize the self-heating effect and thermal resistance [15, 16]. Very few efforts have been taken to reduce channel-temperature and thermal resistance in the device. Hence, there is a great space in optimising device layout and choice of epitaxial layers for AlGaN/GaN HEMT towards the suppression of self-heating effects. In this paper, AlGaN/GaN HEMT with optimized passivation dielectric is proposed to suppress the device heating and thermal resistance. In passivating the GaN HEMT by dielectric material, the Silicon Nitride (SiN) is the most popular choice over the other dielectric materials [17–27]. It is due to the fact that SiN establishes a good quality interface (less dangling bond or surface traps) with GaN or AlGaN layer and thereby reduces the leakage current in the device [23, 28–30]. The SiN dielectric not only reduces the leakage current, but also helps to suppress the current collapse in GaN HEMTs. Thus, the complete elimination of SiN is not an effective technique in optimizing the passivation dielectric. As a compromise, the combination of Diamond and SiN

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Published online: 20 August 2020

Optical Grating Techniques for MEMS based Spectrometer - A Review

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***Abstract*— This paper examined the innovations of the spectrometers for the measurement of consistency based parameters of the handheld Micro Electronic Mechanical System (MEMS) Spectrometer. Fast, highly sensitive, miniature spectroscopy techniques empowered quick, savvy and effective measures for various applications. In the light spectroscopy-based identification and quantification, advances in the field of wavelength discrimination are significant and essential. The identification of grid parameters and limiting conditions are necessary for the design and fabrication of diffraction gratings, for the spectrometer. This work evaluates the emerging trends in Micro-Spectrometer's Grating Techniques, focusing on the aspects of grating parameters and the recent developments of grating. The main parameters for evaluating the performance of a grating have been reviewed and found that grating efficiency, groove density, free spectral range and resolving power play a significant part in the grating performance. The fabrication technique employed as well as the materials used in the fabrication process, play a significant role in the efficiency of the grating. Silicon, Silicon dioxide (SiO_2), Glass (Silica glass), Poly methyl methacrylate (PMMA), Chromium and Silicon nitride(Si_3N_4) are the most used materials. The integration of new materials that are ideal for the state-of-the-art semiconductor industry techniques for MEMS fabrication along with a new blazing structure would increase the efficiency of the grating.**

***Index Terms*— Diffraction, Optical Grating, Spectroscopy, System Resolution, MEMS, Spectral Range, Dispersion, Transmission gratings, Diffraction order, Groove density.**

I. Introduction

SPECTROSCOPY can be defined as the analysis of absorption, transmission and radiation emission, and the reliance on the radiation wavelength [1]. The spectrum of the material components are derived from a unique interaction of the material's components with specific electromagnetic wave frequencies (absorption, transmission or emission) [2]. The spectrum of the specific materials will be the graphical interpretation of the resulting interactions with frequency. Today, almost all the technical areas of science and engineering use spectroscopic techniques. The variations between the different materials used, may be observed by means of a comparative study of the electromagnetic spectra of various materials with properties comparable in equal size [3, 4].

The basic diagram of the block demonstrating the spectroscopy theory is displayed in Fig.1. The reactions between the elements in a substance and electromagnetic radiation classify the constituents of the materaila as radioactive, nuclear, supermolecular and microbial. That is, information of the material such as its atoms, molecules, crystal, etc. can be easily obtained from the electromagnetic wave generation process and its source [5]–[7].

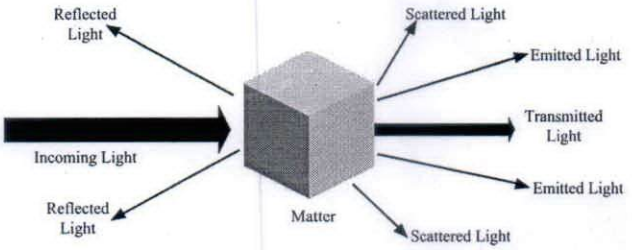

Fig. 1. Basic Spectroscopy Theory

Absorption is electromagnetic energy transfer from the radiation to atoms or molecules in the sample used for the analysis. As a consequence of interaction of the radiation with a sample in solid, liquid or gas state, the electrons that are in the excited state relaxes and goes to an energy state which will be at a lower level by photon emission and the energy of the emitted photons will be similar to the gap in energy between states. Radiation may be emitted from the surface of the sample because of its physical specifications. If the matter is transparent, light will pass through it. When a photon strikes the external layers of an atom, the electron is only absorbed if the amount of energy it carries, kicks the electron from one energy level to higher levels. The photon energies that are not detected in the spectrum are the ones that have equal energy between two energy levels. Spectroscopic analyses are the only

This paragraph of the first footnote will contain the date on which you submitted your paper for review.

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Investigation on the performance of fiber reinforced concrete subjected to standard fire exposure

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Abstract

Purpose – Aim of this research work is to examine the stress–strain behavior and modulus of elasticity of fiber-reinforced concrete (FRC) exposed to elevated temperature. The purpose of this paper is to study the effect of standard fire exposure on the mechanical and microstructure characteristics of concrete specimens with different strength grade.

Design/methodology/approach – An electrical bogie hearth furnace was developed to simulate the ISO 834 standard fire curve. Specimens were exposed to high temperatures of 821°C, 925°C and 986°C for the duration of 30, 60 and 90 min, respectively, as per standard fire curve. Peak stress, peak strain, modulus of elasticity and damage level of heated concrete specimens were evaluated by experimental investigation. SEM-based microstructure investigation has been carried out to analyze the microstructure characteristics of heated concrete specimens.

Findings – The results revealed that carbon fiber reinforced concrete was found to be better than the FRC made with other fibers on improving the modulus of elasticity of concrete. An empirical relationship has been established to predict the modulus of elasticity of temperature exposed specimens with different type of fiber and grade of concrete. In comparison with low melting point fibers, high melting point fibers exhibited higher modulus of elasticity under all tested conditions. Surface damage and porosity level of concrete with carbon and basalt fibers were found to be lower than other FRC.

Originality/value – Empirical relationship was developed to determine the modulus of elasticity of concrete exposed to elevate temperature, and this will be useful for concrete design applications. This research work may be useful for finding the residual compressive strength of concrete exposed to elevate temperature. So that it will be helpful to identify the suitable repair/retrofitting technique for reinforced concrete elements.

Keywords Fiber reinforced concrete, Modulus of elasticity, Basalt fiber, Carbon fiber, Glass fiber, Polypropylene fiber

Paper type Research paper

1. Introduction

Concrete is a versatile building material used in the construction of buildings and structures compared to the other building materials. Concrete structures always provide a reasonably good life span with least maintenance and hence it is the most widely used material than other man-made materials (Lomborg, 2003). The excellent fire resistance property of concrete is because of its ingredients like aggregates and cement. The properties which enable the concrete to resist fire are mainly its low thermal conductivity and high specific heat capacity. Concrete protects itself from fire or elevated heat conditions by acting as a fire shield among its adjacent spaces (Kodur, 2014). In the case of exposure to higher temperatures for a longer period of time, concrete undergoes drastic chemical and physical changes which lead to weakening of concrete (Heikal, 2000; Xu *et al.*, 2001). The type of aggregates and its properties have a significant role on the residual characteristics of concrete exposed to high temperature (Arioz, 2007). The degradations of concrete with different aggregates are not similar when exposed to elevated heat (Sakr and El-Hakim, 2005). Fibers have been widely used to improve the ductility of concrete. It is reported in literature that some fibers help to maintain the properties of concrete after exposure to elevated temperature. The addition of fiber was found to improve the behavior of concrete at elevated temperature and the fiber was found to enhance the peak strain of concrete (Poon *et al.*, 2004). Table 1 gives a brief summary of the research work carried out on modulus of fiber-reinforced concrete (FRC) exposed to elevated temperature.

Although few researchers have reported about the modulus of elasticity of different FRC (except for concrete with steel fiber, polypropylene fiber [PPF] and poly vinyl alcohol fiber

The current issue and full text archive of this journal is available on Emerald Insight at: **https://www.emerald.com/insight/1708-5284.htm**

World Journal of Engineering
© Emerald Publishing Limited [ISSN 1708-5284]
[DOI 10.1108/WJE-04-2020-0138]

Department of Science and Technology, Ministry of Science and Technology, Science and Engineering Research Board, YSS/2015/001196.

Received 28 April 2020
Revised 21 September 2020
Accepted 2 December 2020

ENERGY SOURCES, PART A: RECOVERY, UTILIZATION, AND ENVIRONMENTAL EFFECTS
https://doi.org/10.1080/15567036.2020.1842559

Taylor & Francis
Taylor & Francis Group

Estimation of fuel properties and characterization of hemp biodiesel using spectrometric techniques

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ABSTRACT

Reducing fossil fuel reliance is considered a great challenge for several progressive emerging economies. The development of alternative renewable fuels tends to improve energy security as well as diminish fuel supply vulnerability. This paper details an enhanced protocol intended for the manufacture of hemp biodiesel over two-stage base catalyzed transesterification from crude hemp oil (CHO). The estimation of fuel properties, along with the various spectrometric techniques like Gas Chromatography and Mass Spectrometry (GC-MS), Fourier Transform Infra-Red Spectrometry (FTIR), and Thermo Gravimetry-Differential Scanning Calorimetry/Derivative Thermogravimetry (TG-DSC/DTG) methodologies were used to properly assess the quality and quantity of hemp *(Cannabis Sativa L.)* biodiesel (HB). The density, kinematic viscosity, and cetane number of HB were found to be 876 kg/m^3, 3.91 cSt, and 50, respectively. Since the estimated fuel properties fall well within the range of American Society for Testing and Materials (ASTM) standards, HB could be considered as a sustainable fuel alternative to conventional diesel. GC-MS results demonstrate that the HB contains unsaturated long-chain fatty acids like 9,15-Octadecadienoic acid methyl ester as dominant in the mixture. The FTIR spectrum of crude hemp oil and the synthesized biodiesel confirm the conversion of triglycerides in the CHO into methyl esters in the HB. The findings obtained from TG-DSC/DTG are in near agreement with the results of GC-MS and FTIR. It is therefore proven the hemp oil has abundant potential to be used as an inedible source for the manufacture of bio-diesel.

ARTICLE HISTORY
Received 24 June 2020
Revised 14 October 2020
Accepted 16 October 2020

KEYWORDS
Hemp biodiesel; fatty acid methyl ester; fuel properties; biodiesel characterization; spectrometric techniques

Introduction

Reliable, affordable, safe, and eco-friendly energy supplies are essential for the economic development of a nation, as well as for the overall well-being of an individual. A major share of the global energy demand is being met by fossil fuels like coal, natural gas, and other petroleum products. Compression Ignition (C.I) engines fueled by petro-diesel, are widely used in industrial, agricultural, and transportation sectors due to their versatility in terms of greater fuel efficiency, reliability, lower fuel costs, and safer operation. Researchers have been successful in raising the thermal efficiency of C.I engines considerably in the past. At the same time, the pollutants generated by the combustion of fossil fuels are responsible for the rising environmental concerns like global warming, climatic change, acid rain, respiratory problems to individuals, etc. The ever-increasing population, the higher living standards caused by rapid urbanization and industrialization, dependence on foreign countries for crude oil, the rapid hike in petroleum prices, and the environmental pollution problems caused by the

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Biomass Conversion and Biorefinery
https://doi.org/10.1007/s13399-020-01265-0

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ORIGINAL ARTICLE

Palm stearin biodiesel: preparation, characterization using spectrometric techniques and the assessment of fuel properties

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Received: 11 October 2020 / Revised: 16 December 2020 / Accepted: 29 December 2020

Abstract
In the contemporary era, our planet has been experiencing an unprecedented energy shortage and degradation of the environment. The exhaustion of crude oil reserves, fluctuation in fuel prices, and the escalating environmental pollution problems are driving the researchers worldwide to search for sustainable alternative fuels. This study discusses an enhanced protocol for the production of biodiesel using crude palm stearin (CPS), the nonedible solid portion of palm oil, through alkali-catalyzed transesterification. The significant physicochemical properties of CPS and palm stearin biodiesel (PSB) were analyzed by adopting American Society for Testing and Materials (ASTM) test procedures and contrasted with the commonly used biodiesels, petro-diesel, and ASTM biodiesel standards. The kinematic viscosity, density, gross calorific value, and cetane number of PSB were noticed to be 0.566 cSt, 0.882 kg/m^3, 38,676.90 kJ/kg, and 47.5, respectively. The fatty acid composition and the functional groups present in CPS and PSB were determined by gas chromatography mass spectrometry (GCMS) and Fourier transform infrared spectrometry (FTIR) techniques. GCMS spectra for PSB demonstrated a composition consisting of myristic acid, palmitoleic acid, palmitic acid, elaidic acid, oleic acid, stearic acid, linoleic acid, and eicosapentaenoic acid in varying percentages. The conversion of triglycerides in the CPS into methyl esters in PSB was confirmed by the FTIR analysis. The results of thermogravimetric analyses were also in good agreement with GCMS and FTIR. The closeness of the estimated properties of PSB with petro-diesel and the conformance with ASTM standards indicate the prospective of PSB as an alternative fuel for compressed ignition engines.

Keywords Palm stearin biodiesel · Biodiesel characterization · Alternative fuel · Fatty acid composition · Spectrometric techniques · Thermogravimetric analysis

1 Introduction

The exhaustion of petroleum reserves has resulted in a collective attempt to explore ecofriendly and renewable alternate fuel resources. The continuous increase in crude oil prices and the diminishing fuel reserves have forced numerous scientists worldwide to study the feasibility of lipids obtained from biomass as alternatives to conventional fuels. Many scientists and ecologists have proclaimed biodiesel as the most favorable and sustainable option to lower the dependence on crude oil and to reduce global CO_2 emissions [1]. In addition, the usage of biodiesel also supports the agricultural sector and positively impacts the nation's economy [2]. Biodiesels from vegetable oils have energy content close to petro-diesel and are regarded as an inexhaustible energy source. The biodiesel also offers the advantages of being toxic free and sulfur free and provides better lubricity compared with petro-diesel [3]. Since vegetable oils are produced from renewable sources, they have gained much attention recently as alternative fuels. However, the large molecular size and the higher viscosity associated with vegetable oils prevent their direct utilization in engines. These problems can be resolved, if the vegetable oils are converted to biodiesels [4]. Nevertheless, the use of cooking oils for fuel production cannot be justified as they create a food–fuel conflict, mostly in third world nations [5].

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Published online: 11 February 2021

Optical and Quantum Electronics (2020) 52:367
https://doi.org/10.1007/s11082-020-02481-8

Growth and investigations of 3rd order NLO properties of novel semi organic tartaric acid lithium sulfate single crystal for photonics application

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Received: 17 March 2020 / Accepted: 15 July 2020

Abstract
Single crystals of tartaric acid lithium sulfate (TALS), a semi-organic nonlinear optical crystal has been successfully grown by slow evaporation solution growth technique. Single crystals were grown in a life span of 3 weeks. The grown crystals were characterized by single crystal X-ray diffraction to identify the lattice parameters. Fourier Transform Infra Red studies confirm the presence of various functional groups present in the crystal. Optical, mechanical, microscopic image and thermal stabilities of the title crystal was carried out to know the properties of the titled compound. Third order non-liner studies have also been studied by Z-scan techniques. Nonlinear absorption and nonlinear refractive index were found out and the third order bulk susceptibility of compound was also estimated. The negative sign in the refractive index indicates the self-defocusing nature of the crystal.

Keywords Semi organic crystal · Optical properties · DSC analysis · Mechanical properties · Z-scan technique

1 Outline

Recently, many young researchers are focusing their interest towards the development of third order semi organic nonlinear optical crystal. Because of its wide application in the field of LASER, photo detectors, computers, optical calculators, signal processing, etc. (Terkia-Derdra et al. 2000; Fuks-Janczarek et al. 2005; Zawadzka et al. 2013). The emerging materials must possess shorter UV cutoff wavelength, large optical transparency window and high nonlinearity. Among them the semi organic materials show prominent properties due to their fast and large nonlinear response over a broad frequency range and large optical damage threshold (Kulyk and Turko 2007; Chithambaram et al. 2011; Chithambaram and Krishnan 2014). The existence of strong nonlinear absorption, the optical limiting property is clearly visible in organic materials which

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Published online: 28 July 2020

Biomass Conversion and Biorefinery (2020) 10:619
https://doi.org/10.1007/s13399-020-00906-8

EDITORIAL

Thematic issue: energy provision from organic by-products, residues, and wastes in Asia

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Published online: 30 July 2020

Due to fast industrialization and increasing population, large quantities of organic wastes are being generated in different forms such as solids, liquids, sludge, and gases. These wastes include among others agricultural wastes and crop residues, excreta from animals, slaughterhouse waste, organic household waste, polluted waste water, wood processing residues, and waste from fruit markets. Each city produces tons of organic wastes daily from households, hospitals, industry offices, market centers, restaurants, etc. Every year in the world, several million tons of organic wastes are being disposed through different ways such as incineration, anaerobic digestion, land applications, and land filling.

This globally available and to be treated organic waste has a high potential to be used as a bio-renewable energy resource and to be turned into high-value by-products. This thematic issue titled "Energy provision from organic by-products, residues and wastes in Asia" within the *Biomass Conversion and Biorefinery* (Journal) highlights recent advances of our understanding on energy production from different waste streams in Asia.

The above thematic issue consists of state-of-the-art and original research works involving experimental and numerical studies, recent developments, and novel and emerging technologies in the area of energy production from organic waste. This thematic issue covers the thermo-chemical and biochemical conversion systems including gasification of palm kernel shells, groundnut shell, and *Madhuca longifolia* biomass to bioenergy. Additionally, saccharification of lignocellulosic biomass for bioethanol production, utilization of waste coconut meal for biodiesel and bioethanol production, and usage of beef tallow for biodiesel are tackled. Beside this, anaerobic digestion of perennial grass, textile industries wastes, food waste, and water hyacinth for biogas (biomethane) production have been addressed. We believe that the readers will enjoy reading the scientific articles and will collect many new scientific impressions and insights from this thematic issue.

Finally, we would like to thank the authors of this thematic issue for their valuable contributions and all the reviewers for their helpful comments and suggestions greatly helping to enhance the quality of the papers.

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Neural Processing Letters
https://doi.org/10.1007/s11063-020-10292-x

Super-Resolution Based Automatic Diagnosis of Retinal Disease Detection for Clinical Applications

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Abstract
In medical image processing, the automatic analysis of pathology localization and the anatomical segmentation steps are more important. The Fundus images of Low resolution (LR) are not applicable to detect the retinal disease. The main aim of this paper is to enhance the resolution of the low-resolution retinal images obtained from the cheap imaging devices within less computational time and high accuracy. So, we proposed the fundus image with Super-Resolution and its performance via the Diagnostically Significant Area (DSA). This approach focuses only on the region of Interest (ROI) instead of concentrating on the entire image leading to less computational time by reducing the time complexity. Therefore, the Eigen MR inter-band feature, Energy MR intra-band feature, Shannon entropy and Sensitive Contrast Interest (SCI) are used to capture the clinical data from the selected region. Therefore, the DSA is determined by using Levenshtein based KNN classifier. Because of better classification outcomes, the Bicubic method is employed in the selected region to reduce the loss of reconstruction error. Experimentally, the implementation works are carried out in the platform of MATLAB with DRIVE and STARE database images are chosen. The super-resolution image performances are compared with different start of art techniques such as PSM, GR-SR, LLE, and SpC-SR. Finally, higher efficiency with low computational super-resolution fundus images is collected.

Keywords Retinal image · Super-resolution · ROI · Fundus · KNN

1 Introduction

The degeneration of age-related muscular, Diabetic Retinopathy (DR) disease and the retinal problem diagnosis are carried out by using Fluorescein Angiographic (FA). In the diabetic population, the main reason for the blindness and low vision is Diabetic Macular Edema (DME). When compared to Proliferative diabetic retinopathy, the DME contains more visual loss. For ophthalmologists, the diagnosis and prediction of various eye diseases from the muscular area is an important task [1]. Hence, progressive disease is

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Published online: 01 July 2020

ISSN 0975-2366
DOI:https://doi.org/10.31838/ijpr/2020.12.02.247

Research Article

CAD Systems for Automatic Detection and Classification of Covid-19 in Nano CT Lung Image by Using Machine Learning Technique

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Received: 19.04.20, Revised: 19.05.20, Accepted: 19.06.20

ABSTRACT
The WHO has declared Human Coronavirus (HCoV) ongoing outbreak to be a global public health emergency. Corona virus (HCoV) was reported two months ago in Wuhan, China. Health care systems over the world get into a chaotic mode due to limited capacity and a hectic increase of suspected coronavirus cases. The one thing that everybody is trying to do is to reduce the effect of cause created for a patient. This study will show how Machine Learning technique can be used for classifying the infected and healthy lung using the nano scaling imaging technique of computed tomography (CT) lung scans. Pre-processing is used to reduce the effect of intensity variations and for noise removal between CT slices. Then thresholding and other morphological operation is used to separately isolate the background of the CT lung scan. Each dataset that we take undergoes a texture-based feature extraction method in which it uses GLCM along with a wrapper method for optimization. The obtained features are classified using a Deep convolutional neural network, which will classify in several layers. By giving our input of scan images it will train in an efficient manner and gives us an accuracy of 99%.

Keywords: Nano Technique, GLCM, Deep Convolutional Neural Network, COVID-19, Pneumonia.

INTRODUCTION
COVID-19 also known as coronavirus which already have the presence in December 2019 named SARS-2 but mainly create cause from 2020 in which it basically affects the respiratory system. WHO declared this virus as a pandemic nature due to its widespread [1]. The most common cause of this virus is cough, cold that leads to infection [2]. Several characteristics can influence its severity: weak or impaired immune system, chronic diseases like asthma or bronchitis, elderly people and smoking. The treatment depends on the organism responsible for the infection, but usually requires antibiotics, cough medicine, fever reducer and pain reliever.

International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075, Volume-9 Issue-2S2, December 2019

Automating the Drug Dosage of Tacrolimus for Liver, Renal Transplant Patients using Neural Network

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Abstract: ***Nowadays in medical field the major concern lies in the field of liver, renal diseases. Liver is the largest organ in the body and it is the factory which processes all the foods we taken. We should keep liver in perfect condition. But today there were lot of Liver, renal damages occurred commonly. where sluggish lifestyle of humans and escalated alcohol abuse has become dangerously common, liver ,kidney health have regained focus. This can cause liver cirrhosis and liver dysfunction. The main solution for this is transplantation surgeries. In most of the cases, transplantation surgeries are successful. But after few days normal patients become die. its a very common news. This is because of the lack of ideal drug dosage prediction. Today all of the medical practitioners calculate manually using some patients responses towards the drug. So it is not a systematic approach. Only purely mathematical approach is available for calculating drug dosage.***

To achieve an optimal drug dosage calculation, proposed model will automate this system based on some patients response data like cell viability, drug trough level, Creatine Test result, biopsy result, MELD score etc using some artificial intelligence techniques like neural networks. The human and monetary of both optimal and Sub- optimal drug dosage may be deduced from the action of various optimized neural networks. Neural networks provide sceptical help to doctors. Currently there is no system will automize this dosage calculation. This calculation based on patients responses after transplantation surgery. Normally start with zero level dosage of medicines. After few days the ideal drug usage calculations occurred based on some observing patients different levels of data. Automate this system will help to doctors to calculate automatically the optimal usage of drugs makes precise calculations in the patients health.

Keywords – Artificial Intelligence, Artificial Neural Network, MELD score, Tacrolimus

I. INTRODUCTION

In medical field, there were lot of medical procedures implemented with the help of computer applications nowadays. Today it's necessary to keep all detailed patient's data using computer. Many of the techniques developed for medical imaging (CT scan , MRI scan) implemented using computer technologies. Robotic technologies (including surgical robots and rehabilitation robots) are widely used for many of the surgical procedures. The use of computer applications range in health care will be widely increased. Currently the application of computer technologies are widely used in drug therapy also. In this the major experiments will concentrate on optimal drug dosage calculation.

Revised Manuscript Received on December 15, 2019.

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Because Inter variability and individual variability in requirements of dosage formally use guided by physicians quantified drug management, which gives in rampant variations from the objective dosage ranges.[12] Normally once a peculiar drug is chosen, the pharmacokinetics clinical principles are required to assure the pertinent management of drug is chosen for an administration appropriate route . On the basis of the patient's handling parameters of drug, which require a considerate of one basic pharmacokinetics metabolism and excretion, absorption, distribution, the regimen of dosage for the medicine in a appropriate patient can be developed. It is necessary to ensure that the appropriate regimen is prescribed to achieve optimal adequacy and nominal toxicity. Nowadays there were lot of liver and kidney diseases widely increased. The new lifestyle of the peoples were highly influenced these type of chronic diseases. Some of the diseases which will lead to the transplantation of liver or kidney.[1]
These are:

viral hepatitis
Alcoholic liver disease
Autoimmune hepatitis
Acute liver failure
Autoimmune diseases, such as lupus and IgA nephropathy
Nephrotic syndrome
Urinary tract problems

In these liver, kidney failures, the only solution for this is liver, kidney transplantation. Here the major reason lies in the lifestyle change and misconceptions about health in between people. where sluggish lifestyle of humans and escalated alcohol abuse has also the reasons for this kind of liver, kidney damages[2].
Transplantation is the procedure of the deportation of tissue from one part of the body or from one individual and its implantation or insertion in another . Most of the organs will be transplanted nowadays. Transplantation have vital role in survival of patients. In case of transplantation, tacrolimus is the main drug used for suppressing the immunity. For every person receives an organ or tissue from someone else during surgery of transplantation, that person's immunity system may observe that it is foreign. It is because of the person's immune system distinguish that the antigens on the cells of the organ are different. Mismatched organs, or tissues that are not matched intently enough, can generate a blood exchange reaction or transplant rejection.

Published By:

© July 2020| IJIRT | Volume 7 Issue 2 | ISSN: 2349-6002

Performance Analysis of different Classifiers for Earthquake prediction: PACE

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***Abstract*— Earthquakes are catastrophic geo-hazards that endanger human life. Predicting the occurrence of earthquakes is very helpful to reduce the harmful effects. Therefore, a system to predict the forthcoming earthquakes and issues warning promptly are very appealing. There have been researches going on in the machine learning area to predict the earthquakes by the statistical methods based on the previous events recorded. However, the prediction of earthquakes suffers from the class imbalance problem as these events occur very rarely. This system is built to analyze the performance of various machine learning algorithms. The class imbalance problem of the data set is reduced using the resampling method. The system is trained using different algorithms namely: Support Vector Machine, K-Nearest Neighbour, Decision Tree, Logistic Regression and Naive Bayes. The performance is evaluated based on the values of accuracy, precision, recall, and f-measure. To increase the performance, k-fold cross-validation is implemented and performance is again evaluated. This cross-validation is carried out for three different values of k such as 5, 10 and 15. The system is evaluated with both class imbalance problem prevailing dataset and class imbalance problem resolved dataset. The performance is plotted and the optimum value of k for k-fold cross validation is found out. It also identifies which classifier is best for the prediction of earthquake.**

***Index Terms*— Decision Tree, Earthquake, K-fold cross-validation, K-Nearest Neighbour, Logistic Regression, Machine Learning, Naive Bayes, Support Vector Machine**

I. INTRODUCTION

Human faces many natural disasters like flood, earthquake, landslide and volcano in their life. These disasters cause great loss to human life. The main issue with these disasters is that they are unable to correctly predict. Investigations are going on in predicting these disasters based on the previously occurred events. Earthquakes are one of the major catastrophic geohazards and their unpredictability causes severe destruction in human life. Earthquakes are results of the sudden release of energy in the Earth's crust. This results in the shaking of earth which is named as the earthquake. This also creates elastic energy waves known as seismic waves. PACE is based on the quantitative earthquake dataset and the use of machine learning algorithms for differentiating the hazardous and non-hazardous region. Supervised learning technique is employed as earthquake prediction is a classification problem. Algorithms used for the study are SVM, Naive Bayes, K-Nearest Neighbour, Logistic Regression and Decision Tree. Even though logistic regression is considered as a regression algorithm, its output will be either 0 or 1. Thus it can be used for classification problem. Each algorithm will classify the data into the hazardous region or nonhazardous region. The splitting of the dataset into the training set and the test is done using the sampling method and kfold cross validation. Firstly the system is trained with the imbalanced dataset and then with the balanced dataset. Finally, the performance is evaluated based on accuracy, precision, recall and f-measure and the best classifier for the earthquake prediction problem is identified

K-fold cross-validation is carried out for three different values of k such as 5, 10, and 15. All the performance results are plotted and the optimum value of k for k-fold cross validation is also identified.

II. LITERATURE SURVEY

The literature review includes papers which covers almost all aspects of earthquake detection. The details of some papers are given here:

Expert Systems With Applications 129 (2019) 260–272

Contents lists available at ScienceDirect

Expert Systems With Applications

journal homepage: www.elsevier.com/locate/eswa

Enhanced sparse representation classifier for text classification

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ARTICLE INFO

Article history:
Received 22 July 2018
Revised 2 April 2019
Accepted 2 April 2019
Available online 3 April 2019

Keywords:
Text classification
Sparse representation
Orthogonal matching pursuit
Dictionary

ABSTRACT

Classification of text based on its substance is an essential part of analysis to organize enormously large text data and to mine the salient information contained in it. It is gaining greater attention with the surge in the volume of on-line data available. Classical algorithms like *k*-NN (k-nearest neighbor), SVM (Support Vector Machine) and their variations have been observed to yield only reasonable results in addressing the problem, leaving enough room for further improvement. A class of algorithms commonly referred to as Sparse Methods has been emerged recently from compressive sensing and found numerous effective applications in many areas of data analysis and image processing. Sparse Methods as a tool for text analysis is an alley that is largely unexplored rigorously. This paper presents exploration of sparse representation-based methods for text classification. Based on the success of sparse representation based methods in different areas of data analysis, we intuitively hypothesized that it should work well on text classification problems as well. This paper empirically reinforces the hypothesis by testing the method on Reuters and WebKB data sets. The empirical results on Reuters and WebKB benchmark data show that it can outperform classical classification algorithms like SVM and *k*-NN. It has been observed that obtaining the basis of representation and sparse codes are computationally costly operations affecting the performance of the system. We also propose a class-wise dictionary refinement algorithm and dynamic dictionary selection algorithm to make sparse coding faster. The addition of dictionary refinement to the classification system not only reduces the time taken for sparse coding but also gives improved classification accuracy. The outcomes of the study are empirical verification of sparse representation classifier as a text classification tool and a computationally efficient solution for the bottleneck operation of sparse coding.

1. Introduction

Text classification or categorization is the process of assigning structured or unstructured text documents to predefined categories or labels. The text can be off-line or on-line and of any size. It is an integral part of the analysis of the text data with wide-ranging applications like document retrieval, opinion mining, email classification, and spam filtering. Text classification process consists of many stages like data aquisition, data analysis and labelling, feature construction, feature weighting, feature selection, feature projection and classifier design. This paper proposes methods to apply the idea of sparse representation in designing the classifier for text classification. Empirical comparisons of our proposal with classical algorithms like *k*-NN (k-nearest neighbor), Naive Bayes and SVM(Support Vector Machine) indicate the potential of sparse methods as a powerful tool for text classification. Numerous works have already been reported in literature, using most of the popular classifiers. Majority of the text classification techniques are based on Decision trees, Naive Bayes classifier, *k*-Nearest Neighbors (*k*-NN) classifier, Rocchio classifier, Support vector machines and Neural Networks.

Text classification is widely studied by machine learning community and most of the major classification techniques have been applied on this problem with varying levels of accuracy and effectiveness as we can see from the literature (Aggarwal & Zhai, 2012; Mirończuk & Protasiewicz, 2018). This paper proposes sparse representation based methods as an effective tool for text classification with results outperforming many of the existing approaches like *k*-NN (k-nearest neighbor), Naive Bayes and SVM (Support Vector Machine). Sparse representation has already found application in diverse areas of data and signal processing, achieving commendable performance. However, with the exception of a few works such as Sainath et al. (2010) and Sharma, Sharma, Thenkanidiyoor, and Dileep (2016), sparse methods are yet to find serious attention in the field of document classification.

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https://doi.org/10.1016/j.eswa.2019.04.003
0957-4174/

Received November 30, 2018, accepted December 6, 2018, date of current version July 23, 2019.

Digital Object Identifier 10.1109/ACCESS.2019.2891632

Segmentation by Fractional Order Darwinian Particle Swarm Optimization Based Multilevel Thresholding and Improved Lossless Prediction Based Compression Algorithm for Medical Images

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ABSTRACT The image segmentation refers to the extraction of region of interest and it plays a vital role in medical image processing. This work proposes multilevel thresholding based on optimization technique for the extraction of region of interest and compression of DICOM images by an improved prediction lossless algorithm for telemedicine applications. The role of compression algorithm is inevitable in data storage and transfer. Compared to the conventional thresholding, multilevel thresholding technique plays an efficient role in image analysis. In this paper, the Particle Swarm Optimization (PSO), Darwinian Particle Swarm Optimization (DPSO), and Fractional Order Darwinian Particle Swarm Optimization (FODPSO) are employed in the estimation of the threshold value. The simulation results reveal that the FODPSO-based multilevel level thresholding generate superior results. The fractional coefficient in FODPSO algorithm makes it effective optimization with fast convergence rate. The classification and blending prediction-based lossless compression algorithm generates efficient results when compared with the JPEG lossy and JPEG lossless approaches. The algorithms are tested for various threshold values and higher value of PSNR indicates the proficiency of the proposed segmentation approach. The performance of the compression algorithms was validated by metrics and was found to be appropriate for data transfer in telemedicine. The algorithms are developed in Matlab2010a and tested on DICOM CT images.

INDEX TERMS Compression, Darwinian Particle Swarm Optimization, Fractional Order Darwinian Particle Swarm Optimization, Particle Swarm Optimization, segmentation, thresholding.

I. INTRODUCTION

Image segmentation refers to the process of extraction of the desired region of interest. In medical images, the region of interest represents anomalies or anatomical organs. Image compression role is inevitable for data storage and transfer in telemedicine. The lossless compression algorithms are preferred for medical images since the reconstructed image quality is good for the validation by physicians. The thresholding is a classical segmentation technique and many variants like iterative thresholding, bi-level thresholding, local thresholding based on specific features and thresholding based on optimization techniques are there in literature.

Moallem *et al.* [1] used Adaptive Particle Swarm Optimization (APSO) for optimal selection of threshold in benchmark images; fewer error rates were produced when compared with Otsu's and Genetic algorithm (GA).

TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 9138 - 9151

Neural Proliferation using Brain stimulation Methods Intended for Pediatric Neuropsychiatric Population: A Hypothesis and Theoretical Investigation

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Article Info
Volume 82
Page Number: 9138 – 9151
Publication Issue:
January-February 2020

Abstract:

It is estimated that 7 – 8 per cent of the total world population comprises of mentally disabled people further within 75 – 90 per cent are intellectually challenged. Apart from this, there is a considerable rate of children who are suffering from cognitive syndromes. Many people around the world are affected by neuropsychological disorders. Unfortunately, there are no adequate solutions for strengthening their capacity and all such methods are in the infancy stage and they are dealing with animal models. This paper will provide a bird's view of existing solutions and the recent trends that are commercially available. In addition, we are developing a unique method that will be a promising solution for treating neuropsychological disorders. There are commerciallymany tools available to assess the rodents' behaviour and all these systems are application specified and developed for Deep Brain Stimulation studies. A system that stimulates multiple neurons along with the reward center intended for treating intellectually challenged, neurological and psychiatric subjects and the patients with brain stroke is yet to be evolved. We are developing a system that will show a new horizon in these areas. The futuristic design of our product will lead the degraded society into light and nurture them with a life of equal standardwith others. The main challenge is to verify the system in an animal model before introducing it in humans.

Article History
***Article Received**: 18 May 2019*
***Revised**: 14 July 2019*
***Accepted**: 22 December 2019*
***Publication**: 09 February 2020*

***Keywords:** Deep Brain Stimulation, Intracranial Self-Stimulation, Implant, Stimulations..*

I. INTRODUCTION

In the study of the neural basis of behaviour, electrical stimulation of brain is an important tool. It is a fruitful technique to explore the brain-behaviour relationships. Studies show that there is a considerable response when we provide stimulations in specified regions. It is treated as one of the strongly remunerating conduct encounters; maybe it is more compelling than encouraging or sexual prizes. Self-incitement encounter which includes repetitive exercises of emphatically remunerating circuits may result in critical changes in dendritic arborization of the neurons of limbic and neocortical districts.

Intracranial self-stimulation experience helps to increase the spine, dendritic arborization and synaptic concentration and fasten neuro transmission [1]. In any case, it was suspicious this was because of a remunerating feeling or because of direct electrical incitement. A study was conducted to answer this question by Dr. B. S. Shankaranaryanakao, Dr. C. Desiraju and Dr. T. R.

TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 9186 - 9194

3

Intelligent Parking Management System using Dijkstra's Algorithm with Driver Preferences

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Article Info
Volume 82
Page Number: 9186 – 9194
Publication Issue:
January-February 2020

Article History
***Article Received**: 18 May 2019*
***Revised**: 14 July 2019*
***Accepted**: 22 December 2019*
***Publication**: 09 February 2020*

Abstract:
Abstract— Car Park is a dynamic system where cars are constantly entering and leaving the parking area. The aim of this work is to develop an algorithm, that assigns a parking slot based on the driver's criteria, especially in a mall/building Car Park. Here, the driver's preferences are considered while choosing a slot to park his/her car. Some of these preferences include driving distance, walking distance, environmental factors, and other factors. Here the driving distance is the shortest path between the entrance and the assigned parking slot. It is found out by using Dijkstra's Shortest Path algorithm. Walking distance is the Euclidean distance between the mall/building entrance and the parking slots. Environmental factors considered here are car occupancy at both sides of a slot and shape of the slot. Other factors include multiple entrances (two entrances are used in this study) and a slot assignment strategy (FIFO). The principles of fuzzy logic are being applied here for helping the driver to make a decision on which slot to choose by assigning fuzzy weights to the slots.

***Keywords:** Car parking mechanism; Dijkstra's Shortest Path algorithm; Euclidean distance; Fuzzy logic.*

I. Introduction

The common method of finding a parking space in a mall/building Car Park is to find it manually which is time consuming and may lead to the worst case scenario of not finding a slot, especially if the driver is driving in high traffic conditions. The alternative is to choose a pre-defined parking space with high capacity. However, this is not an optimal solution as the car park could usually be far away from the user destination. The main motivation behind this study is the fact that not much research has been done in the area of automating the selection of a parking slot based on the driver's preferences.

"Recently, research has used vehicle-to-vehicle and vehicle-to-infrastructure interaction with the support of various wireless network technologies such as Radio Frequency Identification (RFID), ZigBee, Wireless Mesh Networks and the Internet"[4]. This work initially targeted to conduct a study of providing information about nearby parking spaces for the driver and make a reservation prior to his/her arrival to the car park using supported devices such as Smartphones or Tablet PC's. Later the work has been extended to choose a convenient parking slot in a car park

International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN(P): 2249-6890; ISSN(E): 2249-8001
Vol. 9, Special Issue, Aug 2019, 1-13

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SIMULATION ON THE GENERATION OF ELECTRICITY FROM RUNNING TRAIN WHEELS

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ABSTRACT

The existence of industrial actions and our communal construction depends on low cost and continuous supply of electrical energy. Even the advancement of a country is self-possessed in positions of per capita intake of electrical energy. The same is in the case of trains, the major network of transport in India. This paper emphasis on the design of electrical energy in the supreme advanced technique. In this paper rotational energy is used for the assembly of electricity. When associated to other procedures of energy like solar, fuel cell etc., the rotational energy has extraordinary efficient ways and means for producing electricity. This paper purposes of setting up miniature power stations at the foul points of the railway rail wherever the fuel supply is limited. The prevailing structure of train wheels are operated in the making of electricity over other minor rollers close-fitting to the rail. These minor rollers rotate and this rotational energy can be amplified and transformed. This obtained electrical energy supply that can be used as unrestricted power supply for railway utilities such as water streaming, charging electrical gadgets, LCD display supply for traveler list, train time scheduling, lighting the podium bulbs, fan, signal lights etc. Most crowded cities like Mumbai, Chennai and Delhi etc. in India such scheme can be definitely implemented. The proposal of the corresponding scheme equally at the entrance and departure path in the railway station or when mounted at intersections nearby rural area, can afford electricity free of cost for minor scale actions.

KEYWORDS: *Rotational Energy, Traction, Train Wheel, Roller, Podium, Regenerative Braking, Conversion, Rotational Speed, Tensile Strength & Fouling Mark*

Original Article

INTRODUCTION

An electric power commencing has an additional source of prime energy in the electricity generation and its development. While considering the electrical efficacy, this is the major method that used in the commutation of clients using electricity [1][3]. Thus in further developments transmission, distribution, in addition electrical power storage and its recovery by means of pumped storage methods are approved by electric power industry. Electrical energy is an utmost produced at power station mainly driven by heat engines fuelled by combustion or nuclear fission by using electromechanical generators. This similar action occurs by an extra means which is comparable to kinetic energy of flowing water and wind [2]. Mainly the energy sources comprise of geothermal power as well as solar photovoltaic.

The main factor of generation of electricity has followed by several methods but depend on the demand and utility it deserves. The region where the generation of the system implemented also has an importance. There

Materials Letters 257 (2019) 126674

Contents lists available at ScienceDirect

Materials Letters

journal homepage: www.elsevier.com/locate/mlblue

Investigation on novel bulk size single crystal of Glycine with metal ions grown by solution growth method for photonic applications

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ARTICLE INFO

Article history:
Received 25 April 2019
Received in revised form 13 September 2019
Accepted 14 September 2019
Available online 21 September 2019

Keywords:
Crystal growth
Optical studies
Hardness

ABSTRACT

Single crystals of Glycine Potassium dichromate (GPDC) were successfully grown by slow evaporation method at an ambient temperature. Single crystal X-Ray diffractometer was utilized to measure the lattice parameters and to confirm the crystal system. The functional groups present in the grown GPDC crystal have been identified by the FTIR spectral analysis. The optical absorption studies were carried out so as to confirm the lower cut off wavelength of the grown crystal which has been analyzed by making use of UV–Vis spectrum. The mechanical hardness of the sample has been studied. The existence of second harmonic generation signals was observed using Nd:YAG laser with fundamental wavelength of 1064 nm possessing SHG efficiency of 1.3 times greater than that of KDP and hence it can be a potential material for the frequency- doubling process.

1. Introduction

For the past few years, the search of high quality nonlinear optical (NLO) crystals continue to occupy the centre stage research surging all the way with unprecedented progress due to their potential multi level applications in the field of photonic and optoelectronic technologies. Extensive studies have been made on the synthesis and crystal growth of new NLO frequency conversion materials because of their predominant presence in frequency shifting; optical modulation, optical switching and optical memory for the emerging technologies in areas such as telecommunications, signal processing and optical inter connections [1–7]. In this investigation, a successful attempt has been made to grow a novel single crystal of Glycine Potassium dichromate by slow evaporation method and to study their optical and mechanical properties [8–14].

2. Crystal growth

The starting material was synthesized by taking Glycine and Potassium Dichromate in the equal molar ratio. The calculated amount of Glycine and Potassium Dichromate was dissolved in distilled water at room temperature. The prepared saturated solution was allowed to evaporate at room temperature. During the slow evaporation, the nucleation starts paving the way for the seed crystals to be formed. After a few recrystallization processes, a good quality single seed crystal was chosen for the growth of bulk crystal. The seed crystal tied with a thread was placed again at the immersed position of the saturated solution so as to allow the bulk crystal to be grown as slow evaporation continued throughout the growth process and the growth set up is shown in Fig. 1a. GPDC crystal having the dimensions of $10 \times 9 \times 7$ mm^3 has been grown within 27 days as shown in Fig. 1b.

3. Results and discussion

3.1. Single X-ray diffraction analysis

The single crystal XRD instrument ENRAF NONIUS CAD4 X-ray diffractometer is used to collect lattice parameters and space group. It was observed that the crystal belongs to Triclinic system with the following cell dimensions a = 7.412 Å, b = 8.501 Å, c = 12.471 Å, $\alpha = 96°$, $\beta = 97°$, $\gamma = 90$, and volume 785 Å^3 with Non - Centro symmetric space group P.

3.2. UV–VIS–NIR analysis

The optical absorption spectrum for the grown GPDC single crystal of 3 mm thickness was recorded in the range 200–800 nm using Varian Cary – 5E Spectrophotometer and is shown in Fig. 2

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https://doi.org/10.1016/j.matlet.2019.126674

International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN(P): 2249–6890; ISSN(E): 2249–8001
Vol. 9, Special Issue, Aug 2019, 111-116

TRANS STELLAR
• Journal Publications • Research Consultancy

AN OPTIMIZATION OF MICRO-DRILLING PARAMETERS IN CARBON FIBER REINFORCED POLYMER USING GREY RELATION ANALYSIS

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ABSTRACT

In the present investigation, the influence of drilling parameters such as feed rate, spindle speed, drill diameters in drilling is studied. Drilling experiments have been conducted with three sets of input process parameters such as cutting speed of 1800, 3800 and 5800 rpm, feed varied from 15, 25 and 35 mm/min in three steps using conventional twist drills of three different diameters of 0.6, 0.7 and 0.8mm respectively. A rectangular cross section of Carbon Fiber Reinforced Polymer (CFRP) of having dimensions 150mm x150 mm x 3mm is selected for performing drilling. For optimizing multiple responses, Grey Relational Analysis and Desirability Function are used in this study to optimize the machining process parameter. Multiple response characteristics of delamination factor and material removal rate can be converted into unique response using these methods.

KEYWORDS: CFRP, Grey Relation Analysis, & Delamination Factor

Original Article

1. INTRODUCTION

Machining is the process by which a material is cut to the desired form (shape and size). The machining can be applied to different types of materials such as plastic, composite materials, wood and ceramics. A controlled material removal process is used to process a raw material of the desired shape and size. All products manufactured in the world have been processed directly or indirectly. Carbon fibre is drilled with various drills with a diameter of 0.7, 0.8, and 0.9 mm. Parameters such as spindle speed, feed and diameter vary for the study. The rate of material removal and the delamination factor are also discovered. The tool microscope is used to determine the delamination factor. The optimization is performed according to the Grey method. This method also allows determining the optimal process parameters to obtain a low surface roughness.

Bhojan et al., [1] studied the influence of tool rotation in friction stir welding of Metal Matrix Composites (MMCs). They concluded the experimental study in such a way that higher the tool rotation speed, higher is the hardness of the weld joint of the material. Bosco et al. [2] carried out the drilling exercises on glass fibre reinforced plastic sandwich composites. They optimized the drilling process parameters on delamination of sandwich composites. The test results indicate that the rate of feed is said to be the major influential factor that affects the delamination factor. The research contribution of Venkatesan et al., [3] investigates the machinability properties of hybrid metal matrix composite. The influence of input parameters were optimized through Response Surface Methodology (RSM). The results of experimental study conclude that surface roughness improved with feed rate variation. Experiments were conducted on AISI 304 steel by Nayak et al., [4]

International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN(P): 2249–6890; ISSN(E): 2249–8001
Vol. 9, Special Issue, Aug 2019, 46-59

TRANS STELLAR
• Journal Publications • Research Consultancy

AN EXPERIMENTAL ANALYSIS AND OPTIMIZATION OF HEAT TREATMENT PARAMETERS OF AL6061 ALLOY FOR IMPROVED MECHANICAL PROPERTIES

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ABSTRACT

This present work, investigate the heat treatment behaviour of Al6061 aluminium alloy experimentally and optimizing the results of tensile, impact strength and resistance over the identified input variables viz., aging temperature, medium of cooling and time period of heat treatment using The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). Taguchi's Design of Experiments, a suitable L_9 orthogonal array is opted for performing the experiments. Analysis of Variance (ANOVA), an analytical tool has been used to study the most important parameters. The optimized conditions achieved were: aging temperature of 450°C, oil as quenching medium and aging time period of 30 min. ANOVA result shows that the aging temperature was the most influential parameter, which influences the output responses with an error percentage of 4.15%. At the outset it is noted that the performance of the thermal process can be improved by identifying the most critical parameters using TOPSIS.

KEYWORDS: *Taguchi's Technique, ANOVA, TOPSIS & Aging Temperature*

Original Article

INTRODUCTION

Heat treatment in broad manner, is a process of the heating and cooling tasks that are done to change the mechanical properties and the metallurgical structure of a metal item (Elagin & Zakharov, 1994). In aluminum composites, heat treatment is every now and again limited to the specific tasks utilized for the cast and hardened combinations for improving the hardness and quality (Vasilevskii & Postnikov, 1979), which are generally alluded as the "heat-treatable" compounds to recognize them from those amalgams in which no noteworthy fortifying can be accomplished by heating and cooling. The last mentioned, "non-heat-treatable" combinations, depend basically on work to expand quality. Heating to diminish quality and increment of ductile is utilized with compounds of the two sorts; metallurgical responses may change with kind of composite and with level of softening wanted. Aside from the low-temperature adjustment treatment in some cases given for series of 5xxx alloys, total or fractional heating are the main ones utilized for non-heat-treatable alloys (ASM, 1991). One fundamental trait of a precipitation-type of alloy hardening framework is a temperature-subordinate balance strong solvency described by expanding dissolvability with expanding temperature (Sverdlin et al. 1996; Cheng et al. 2012; Chernyak et al. 1978). In spite of the fact that this condition is met by a large portion of the binary system for aluminum alloy, and normally they are not viewed as heat treatable. Alloys of the aluminum-silicon (Kutsova et al. 1992) and aluminum-manganese, display moderately immaterial changes in mechanical properties because of warmth

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Investigation and Optimization of Machining Parameters Influence on Surface Roughness in Turning AISI 4340 Steel

This paper focuses on the experimental investigation of machining parameters such as cutting speed, feed rate and depth of cut influence over surface roughness parameters (Ra, Ry and Rt) during turning AISI 4340 steel. Further, in order to achieve smaller surface roughness parameter values, the machining parameters are optimized using Taguchi's technique Signal-to-Noise ratio (S/N ratio). Analysis of Variance (ANOVA) is performed to determine the most contributing factor that influences the surface roughness parameters. It is observed that the feed rate is the most significant factor contributing by 70.50%, depth of cut by 18.54% and cutting speed by 9.15%. From the optimum condition obtained, a confirmation experiment is performed and the results obtained shows that the surface roughness parameter values are reduced by 31.63% than the designed experimental values.

Keywords: *Machining parameter; Surface roughness; Taguchi's Technique; ANOVA.*

1. INTRODUCTION

Turning is a process of producing axisymmetric surface by removing unwanted material from the work-piece to produce a desired shape, where the tool moves in a perpendicular plane and the workpiece is hold on a spindle and rotated [1]. The interesting parameters that were associated with the process of turning were cutting speed, feed and depth of cut [2]. The cutting speed can be defined as the relative surface speed of the workpiece with respect to the tool, which is responsible for material removal. The relative motion of the tool with respect to the job in perpendicular direction to cutting speed for the purpose of reaching unmachined surface is called feed [3]. The penetration of the cutting tool into the job, that is beneath the job surface is depth of cut, which is the radial distance in turning, from the unmachined surface of the job to the tool tip [4]. Turning is the finishing operation performed on components to produce final shape of the component with adequate dimension and tolerances [5], for which optimization of machining parameters is performed by most of the researchers.

Surface roughness parameters such as Ra – Average roughness value, Rt – Maximum height of roughness profile and Ry – Average maximum height of profile are of importance in dimensional stability of a machined component subjected to assembly. Fig. 1 shows the surface roughness profile of various parameters [6].

Asilturk and Akkus [7] minimized surface roughness by optimizing the turning parameter using Taguchi's technique during dry turning and found that feed rate has the most significant effect on surface roughness. Tamizharasan and Senthilkumar [8] analyzed the effect of various cutting tool geometries over surface roughness and MRR using Taguchi's technique and by ANOVA. Nalbant et al. [9] optimized the cutting parameters in turning AISI 1030 steel based on the surface roughness produced and found that insert radius and feed rate are the most contributing factors. Ramesh et al. [10] predicted the effect of cutting parameters on surface roughness during turning aerospace titanium alloy (gr5) using response surface methodology model and found that feed rate is the most influencing factor. Kopac et al. [11] determined optimal conditions to achieve desired surface roughness in turning C15 E4 steel by varying the cutting speed, tool and workpiece material, depth of cut and no. of cuts and using coated inserts.

Asilturk and Neseli [12] determined optimum machining parameters for better surface roughness during dry turning of AISI 304 steel using coated carbide insert by response surface methodology and predicted it using the developed mathematical model and found that feed rate is the most contributing factor. Bernardos and Vosniakos [13] have presented various methodologies that are to be followed in predicting the surface roughness and how to reduce it. Sahin and Motorcu [14] used response surface methodology to develop a mathematical formula to predict surface roughness and found that feed rate is the most significant parameter contributing towards surface roughness using ANOVA. Palanikumar and Karthikeyan [15] determined the factors that influence surface roughness during turning Al/SiC particulate composite using carbide tool insert and found that feed rate is the most significant factor, responsible for surface roughness. Verma et al. [16] used Taguchi's technique to optimize machining parameters in turning ASTM A242 Type-1 steel over sur-

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J Opt
https://doi.org/10.1007/s12596-020-00605-7

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RESEARCH ARTICLE

Growth and investigation of novel nonlinear optical single crystal of urea potassium dichromate by solution growth technique for photonic application

V. Chithambaram[1] · T. S. Franklin Rajesh[2] · Geetha Palani[1] · E. Ilango[1] · B. Deepanraj[3] · S. Santhanakrishnan[4]

Received: 29 January 2019 / Accepted: 25 February 2020

Abstract Single crystals of urea potassium dichromate (UPDC) were successfully grown by slow evaporation method at normal room temperature. Single-crystal X-ray diffractometer was utilized to measure the lattice parameters and to confirm the crystal system. The functional groups present in the grown UPDC crystal have been identified by the FTIR spectral analysis. The optical absorption studies were carried out so as to confirm the lower cutoff wavelength of the grown crystal which has been analyzed by making use of UV–Vis spectrum. The dielectric response and the mechanical hardness of the sample have been studied. The surface morphology of the sample was identified using scanning electron microscope. The existence of second-harmonic generation signals was observed using Nd: YAG laser with fundamental wavelength of 1064 nm possessing SHG efficiency of 2.5 times greater than that of KDP, and hence it can be a potential material for the frequency-doubling process.

Keywords Crystal growth · Optical studies · Hardness · Dielectric

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Published online: 14 March 2020

Introduction

For the past few years, the search of high-quality nonlinear optical (NLO) crystals continues to occupy the center stage research surging all the way with unprecedented progress due to their potential multi-level applications in the field of photonic and optoelectronic technologies. Extensive studies have been made on the synthesis and crystal growth of new NLO frequency conversion materials because of their predominant presence in frequency shifting, optical modulation, optical switching and optical memory for the emerging technologies in areas such as telecommunications, signal processing and optical interconnections [1–7]. The consistent work on finding new and efficient NLO materials has resulted in the development of new class of materials called semi-organics, which have the potential for combining high optical nonlinearity and chemical flexibility of organic materials with the thermal stability and mechanical robustness of inorganic materials. In this new class of materials, high-efficiency optical quality organic-based NLO materials form compounds on which polarizable molecule is stoichiometrically bonded to an inorganic host. In this investigation, a successful attempt has been made to grow novel single crystals of urea potassium dichromate by slow evaporation method and to study their optical, mechanical and biological properties [8–12].

Experimental procedure

Material synthesis

The following materials were used for the crystal growth experiments such as urea-($CO(NH_2)_2$), SD-fine AR grade

Biomass Conversion and Biorefinery (2020) 10:675–688
https://doi.org/10.1007/s13399-019-00501-6

ORIGINAL ARTICLE

Production, optimisation and engine characteristics of beef tallow biodiesel rendered from leather fleshing and slaughterhouse wastes

J. Ranjitha[1] · S. Gokul Raghavendra[1,2] · S. Vijayalakshmi[1] · B. Deepanraj[3]

Received: 22 April 2019 / Revised: 10 August 2019 / Accepted: 14 August 2019 / Published online: 8 September 2019

Abstract

Presently, biodiesel is considered as an effective alternate fuel owing to its high sustainability and robustness. This paper concentrates on the biodiesel production from waste beef tallow rendered from subcutaneous and intramuscular wastes discarded from leather tanneries and slaughterhouses. The maximum fat content was estimated to be 92.5% and 3.05%, whereas maximum rendering efficiency was determined to be 92% and 75% for subcutaneous and intramuscular wastes, respectively. The rendered waste tallow was converted into biodiesel using ethanol as a solvent and L-valine amido ethyl methyl imidazolium bromide ([L-Vaemim]Br) as a novel ionic liquid catalyst. The most optimised reaction parameters are as follows: molar ratio of 1:7.5, catalyst concentration of 20 wt% of tallow, reaction temperature of 75 °C and reaction time of 160 min. Properties of the produced biodiesel have been tested in accordance with ASTM Standards, where the results were found to be within the permissible range. The engine characteristics of biodiesel exhibited increased heat release rate and maximum cylinder pressure, reduced emission levels than compared to ordinary diesel; in addition, its performance characteristics were similar to diesel, thereby making it a suitable replacement for existing fossil fuel.

Keywords Leather tanneries · Animal slaughterhouses · Subcutaneous and intramuscular wastes · Fatty acid esters · [L-Vaemim]Br

1 Introduction

Global modernisation and expanding population growth have resulted in larger energy demand, leading to depletion of fossil fuel reserve and increased pollution level caused by these non-renewable energy resources. In addition to that, modernisation has paved a path to waste generation at large-scale level and is usually categorised based on its source of origin and its nature; and are predominantly discarded without proper disposal techniques. These wastes have been the root cause for various anthropogenic activities like soil contamination, water and air pollution, and environmental infection which has an adverse effect on every living thing on this planet [4]. Numerous studies have been carried out to manage these wastes effectively, convert them into a useful product, or dispose it properly through suitable disposal techniques. One such study proposes the effective conversion of these wastes into energy sources, which has the ability to satisfy the growing global demand for energy [22].

Accordingly, leather fleashing and slaughterhouse wastes are such wastes discarded from tanneries and slaughterhouses with good energy potential but cannot be directly used for power generation owing to numerous constraints associated with its nature, availability and its properties (thermal and physicochemical) [5]. However, fat rendered from these wastes can be used for power production using proper treatment and conversion techniques. One such technique is chemical conversion of rendered fat into biodiesel (fatty acid chain linked with alkyl chain through ester group) which reduces its viscosity and makes it suitable for CI engines. Biodiesel is highly regarded for its renewability and self-sustainability, lower toxicity, and higher biodegradability with enhanced combustion rate and reduced emission characteristics. In addition, this non-volatile biofuel has improvised solvent properties along with high oxygen content, zero sulphur and aromatics content [34].

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Bull Mater Sci (2020)43:202
https://doi.org/10.1007/s12034-020-02176-6

Investigation on single crystal by tartaric acid–barium chloride: growth and characterization of novel NLO materials

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MS received 5 March 2020; accepted 20 May 2020

Abstract. The progress of single crystal followed by $C_4H_6O_6$ (tartaric acid) and $BaCl_2$ (barium chloride) (TABC; third-order nonlinear optics semi-organic) was synthesized with slow evaporation method using distilled water at room temperature. TABC single crystal was introduced into various characterizations like X-ray diffraction to determine inter atomic cell parameter values. The samples are crystalline structure of monoclinic, which have space group of P_2. The functional groups of the current material are identified using FT-IR spectrum. Optical parameters like transparency, energy bandgap and Urbach energy have been determined using UV–vis–NIR spectrum. The thermal stability of the material was investigated by differential scanning calorimeter analysis. The mechanical property was studied using Vickers microhardness test. The surface morphology of the material was determined by scanning electron microscope technique. The change in dielectric behaviour of TABC with respect to the function of frequency at various temperatures has been keenly absorbed and discussed. The third-order nonlinear optical parameters were measured using Z-scan analyses.

Keywords. Optical material; XRD; microhardness; thermal study; Z-scan analyses.

1. Introduction

Third-order nonlinear optical materials have wide applications like optical communication, sensing, signal processing, data storages, optical logic gates, laser radiation protection and THz-wave generation [1–5]. In recent years, a broad investigation was performed to develop the nonlinear optical materials with high extensive applications in photonic and optoelectronic fields. Various studies dealing with organic, inorganic and semiorganic crystals for nonlinear optics have been reported. Semiorganic nonlinear optical materials play an important role in technological industry. In literature many of these materials has been reported. The organic materials possess poor mechanical, thermal properties with high nonlinear optical coefficient. The development of bulky single crystal is very tough for device fabrications. An inorganic material has admirable thermal, optical and mechanical properties of rather nonlinearity owing to the absence of electron–π conjugation [6–10]. Nowadays, interest has been made to grow the semiorganic crystals with less delinquency, high laser damage threshold, exceptional mechanical and thermal properties, low angular sensitivity, wide optical transparency, which makes the material comfortable for device fabrications [11–13]. Lakshmi *et al* [14] studied nonlinear optical materials of *N*,*N*-diphenylbenzamide (NNDPB) and 4-fluoro-*N*,*N*-diphenylbenzamide (FNNDPB). The NNDPB and FNNDPB crystals studied using UV–vis-near IR spectra showed results of 100% in the visible area. It is thermally stable up to 483 and 503 K. Second-harmonic generation (SHG) productivity was calculated by the Kurtz–Perry powder method, which is 1.55 and 1.7 times as that of potassium dihydrogen phosphate. Prabukanthan *et al* [15] have analysed *N*-methyl-4-nitrobenzenamine, *N*-methyl-*N*-(4-nitrophenyl)benzamide, 4-fluoro-*N*-methyl-*N*-(4-nitrophenyl)benzamide and 4-methoxy-*N*-methyl-*N*-(4-nitrophenyl)benzamide single crystals through the slow evaporation solution progress. In these crystal structures, thermal analysis was 570 K and the efficiency of SHG was 2.25 times higher than the potassium dihydrogen phosphate (KDP) crystal.

L-tartaric acid is a prominent organic nonlinear optical material. In this study, we report tartaric acid barium chloride (TABC), a third-order nonlinear optical, samples studied by solution growth technique. TABC single crystal was introduced into various characterizations like X-ray

Published online: 12 August 2020

International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN(P): 2249–6890; ISSN(E): 2249–8001
Vol. 9, Special Issue, Aug 2019, 111-116
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AN OPTIMIZATION OF MICRO-DRILLING PARAMETERS IN CARBON FIBER REINFORCED POLYMER USING GREY RELATION ANALYSIS

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ABSTRACT

In the present investigation, the influence of drilling parameters such as feed rate, spindle speed, drill diameters in drilling is studied. Drilling experiments have been conducted with three sets of input process parameters such as cutting speed of 1800, 3800 and 5800 rpm, feed varied from 15, 25 and 35 mm/min in three steps using conventional twist drills of three different diameters of 0.6, 0.7 and 0.8mm respectively. A rectangular cross section of Carbon Fiber Reinforced Polymer (CFRP) of having dimensions 150mm x150 mm x 3mm is selected for performing drilling. For optimizing multiple responses, Grey Relational Analysis and Desirability Function are used in this study to optimize the machining process parameter. Multiple response characteristics of delamination factor and material removal rate can be converted into unique response using these methods.

KEYWORDS: CFRP, Grey Relation Analysis, & Delamination Factor

Original Article

1. INTRODUCTION

Machining is the process by which a material is cut to the desired form (shape and size). The machining can be applied to different types of materials such as plastic, composite materials, wood and ceramics. A controlled material removal process is used to process a raw material of the desired shape and size. All products manufactured in the world have been processed directly or indirectly. Carbon fibre is drilled with various drills with a diameter of 0.7, 0.8, and 0.9 mm. Parameters such as spindle speed, feed and diameter vary for the study. The rate of material removal and the delamination factor are also discovered. The tool microscope is used to determine the delamination factor. The optimization is performed according to the Grey method. This method also allows determining the optimal process parameters to obtain a low surface roughness.

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International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN(P): 2249–6890; ISSN(E): 2249–8001
Vol. 9, Special Issue, Aug 2019, 105–110

THE LOW COST ADULT DIAPER WASTE MANAGEMENT METHOD

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ABSTRACT

***The current** situation of waste disposals constantly embraces a potential danger in environmental degradation. Due to disregard of authorized, fast filling landfills is becoming a troublemaker. Diaper is creating a hefty involvement towards solid wastes without making an allowance for inadequate landfill space. The government is taking keen interest in building up proper sanitation facilities which essentially intend for a hygienic environment but dumped diapers still remain a menace. Traditional method of diaper disposal is unhygienic. In urban areas, most of them are sealed in a plastic bag and moved to landfills, while in rural areas, the major prospect is to burn them. This paper proposes an economic and sanitized way of adult diaper disposal, this can be an assist to many houses, hospitals, old age homes, charity trusts etc.*

***KEYWORDS**: Adult Diaper, Solid Wastes, Disposal, Hygienic & Diaper Waste Management*

Original Article

INTRODUCTION

In this 21st century one of the major issues we are facing is the disposal of sanitary wastes. As we all know that this is due to the plastics which are employed in disposable sanitary napkins are non-biodegradable and leads to environment and health threats. The recent study states that a single woman uses nearly 100 kilograms of non biodegradable waste during her menstrual years. A paralyzed person nearly uses six to seven adult diapers per day, this results usage of approximately two hundred adult diapers per month. The life cycle of a single adult diapers is 450 to 500 years. This context is more conspicuous because of the way in which how municipal solid waste is managed and their collection, disposal and transportation network. Moreover, the main problem of sanitary waste has ever been their categorization, i. e, whether it is a bio-medical or plastic waste. Diapers, soiled napkins, tampons, condoms, and blood-soaked cotton are being disposed of after separation into non-biodegradable and biodegradable segments. However, the Bio-Medical Waste Management Rules, 2016 show that objects tainted with body fluids and blood, including cotton, soiled plaster casts, dressings, lines and bedding, are bio-medical waste and must be incinerated, micro-waved or autoclaved to remove pathogens. The need of interest for sanitary waste management in our nation is shown in the evidence that there is no credible statistics on the problem. Due to the need of separation of waste, there is little documentation in this section, so through guidance for treatment and management of sanitary waste are necessary. As per the studies conducted in 2011, titled 'Sanitary Protection', Every woman's health right' estimated that only about 12% of the 335 million menstruating women can able to dispose of their sanitary napkins. Environment portal Down to Earth estimated that 432 million pads are disposed of per month.

International Journal of Mechanical and Production Engineering Research and Development (IJMPERD)
ISSN(P): 2249–6890; ISSN(E): 2249–8001
Vol. 9, Special Issue, Aug 2019, 94–104

AN OPTIMISATION OF SURFACE AREA AND HEAT TRANSFER STUDY OF RECTANGULAR POROUS STRUCTURE

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ABSTRACT

Heat transfer can be maximized by increasing the surface area which is exposed to convection. Structures which have high surface area compared with volume are called porous structures. In order to increase the surface area of a porous structure to maximum, the fiber width of the structure can be varied. We can maximize the surface area by varying fiber width for the given porosity. Increasing the porosity below a particular point increases the surface area after the limit increasing porosity decreases the heat transfer by decreasing the conductional heat transfer. For the study a cube shaped unit cell model of rubik's cube is chosen.

KEYWORDS: *Heat Transfer, Surface Area, Cube & Porous*

Original Article

INTRODUCTION

In order to improve the durability of an electronic equipment, heat removal can be used as an effective tool. The heat removal rate depends on the area of surface that is exposed to the convection. Depending upon the purpose different size structures is used for increasing the heat transfer rate. According to law of convection, the heat transfer rate can be increased using porous body in thermal system. The usage of porous body will also help reduce weight and space requirement. Porosity can be defined as the measure of the void spaces in a material. It is a ratio of the volume of voids to the total volume. The porosity is expressed between 0 and 1, or as a percentage between 0% and 100%. Materials that contain pores are called a porous material. Matrix is the skeletal portion and the pores are usually occupied by a fluid. By using concept of porous media we can analyze structures like foams, although the skeletal material is normally a solid. This work presents a fresh technique that boosts the heat transfer from the surface by using fins with porosity. The thermal performance of fins with porosity is assessed and paralleled with that of normal solid fins. If we use porous fins in the place of normal fins it will increase the performance of the equal sized normal solid fin and, it will save fin material. The operating parameters, thermal performance of porous fin and the effect of different design is investigated. Ra number, Da number, and thermal conductivity ratio are the examples of these parameters. Increasing the Ra number improves the performance of porous fin. It is found that there is no further improvement in the fin performance after an optimum limit of porosity.

LITERATURE REVIEW

Jian Yang et al. "Forced Convection Heat Transfer Enhancement by Porous Pin Fins in Rectangular Channels". This paper studies the heat transfer the of forced convective nature three-dimensional porous pin fin channels numerically. In the study, air and water both, are being used as cold fluids. The study prudently examines effect of pore density, Renoylds number and pin fin forms. Also, heat transfer and the flow performances in these porous

ENERGY SOURCES, PART A: RECOVERY, UTILIZATION, AND ENVIRONMENTAL EFFECTS
https://doi.org/10.1080/15567036.2019.1636902

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Effect of solid concentration on biogas production through anaerobic digestion of rapeseed oil cake

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ABSTRACT

Solid concentration is considered as one of the most important parameters governing the anaerobic digestion process. In this present study, four solid concentration levels (10%, 15%, 20% and 25% of total solids), were tested to evaluate the effect on biogas production from rapeseed oil cake. Four laboratory scale batch reactors with 2 L volume were used for this study with a retention period of 30 days. The performance of reactors was assessed by quantifying the daily biogas production, cumulative biogas production and the degradation of total solids, volatile solids and COD. Biogas production was found to be maximum at a solid concentration of 20%, followed by 25%, 15% and 10%. The results obtained from the study were evaluated using Gompertz, modified Gompertz and Logistic models to determine the kinetic constants of the process. There were smaller differences between measured and predicted biogas production for rapeseed oil cake when using a modified Gompertz model compared with the other two models.

ARTICLE HISTORY
Received 31 January 2019
Revised 21 May 2019
Accepted 12 June 2019

KEYWORDS
Anaerobic digestion; Biogas; Solid concentration; Kinetic study; Rapeseed oil cake

Introduction

In the 21st century, developing new and alternative energy resources and technologies is a major goal for achieving global sustainable socio-economic advancement as petroleum fuel has been exhausted to an alarming level. Globally, engineers and researchers are researching the potential of cultivated biomass resources as alternatives to fossil fuel energy. In this scenario, developing commercially viable and sustainable technologies for biogas, biodiesel, producer gas, and alcohol production are excellent examples. The economic viability of bioenergy technology ultimately depends on the utilization level of cultivated resources and the energy consumption quantity for producing useful fuel (Chandra et al. 2012; Ghatak and Mahanta 2014).

Biogas production has earned growing interest globally because it is an alternative fuel that can be produced from renewable feedstock. Anaerobic digestion is the most common way to produce biogas, which is broadly practised as the major treatment choice for municipal solid waste (MSW) disposal similar to composting technologies (Ugwua and Enweremadua 2019; Li et al., 2011). It has the advantages of energy recovery, greenhouse gas mitigation, and stable end product generation, and the end products can be composted for land use applications (Alghoul et al. 2019; Zeshan, Karthikeyan, and Visvanathan 2012).

Anaerobic digestion occurs in four distinct stages, namely hydrolysis, acidogenesis, acetogenesis, and methanogenesis (Chynoweth, Owens, and Legand 2008; Tambone et al. 2013). These stages occur through the effects of syntrophy by microbial consortia. In the first stage, monocarbonates and

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/UESO.

Biomass Conversion and Biorefinery
https://doi.org/10.1007/s13399-020-00646-9

ORIGINAL ARTICLE

Biogas from food waste through anaerobic digestion: optimization with response surface methodology

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Received: 3 December 2019 / Revised: 5 February 2020 / Accepted: 16 February 2020

Abstract
In the current study, anaerobic digestion method efficiency on biogas production and chemical oxygen demand (COD) degradation was assessed through a sequence of laboratory-scale batch experimentations to compute the role of chosen process parameters, viz., solid concentration (5–15%), pH (5–9), temperature (30–60 °C), and co-digestion (0–40% of poultry manure). Biogas production and COD degradation were significantly dependent on the selected process parameters with independent conditions to accomplish active performance of the process. Central composite design (CCD)-based response surface methodology (RSM) was adopted for evaluation and optimizing of the combined performance of system considering two responses. Among various combinations, it was observed that solid concentration of 7.38%, pH value as 7, temperature at 48.43 °C, and co-digestion as 29% produce biogas of 6344 ml and COD degradation as 38%. Confirmation experiment performed shows a deviation of 4.93% maximum between the predicted and experimental results.

Keywords Anaerobic digestion · Biogas production · Multi-objective optimization · Alternative energy · Food waste · Soft computing

1 Introduction

Energy and resource shortage is one of the most significant problems faced by the world nowadays. The rising price of petroleum products and increasing attention regarding environmental impacts together with the fossil fuel depletion have prompted considerable research to identify renewable and alternative fuel sources [1, 2]. Therefore, researchers concentrate on finding alternative energy sources and employing them to reduce adverse effects. Most of the studies shown in the literature on renewable energy sources have focused on different waste energy sources. These wastes include used tires, trees, plastics, municipal solid wastes, etc. These wastes have several adverse impacts on environment and living organisms including human beings. These impacts can be reduced when they are transformed into fuel. Out of all the available wastes, food waste contains a considerably large quantity of organic matter, which can be fermented anaerobically to produce biogas [3, 4].

The food waste comprises un-consumed food items and leftovers during the preparation of foods from houses, hotels, institutional sources like college/school cafeterias, and industrial sources like factory lunchrooms [5]. In 2011, a report published on global food waste by UN Agriculture Organization stated that nearly one-third of the total food prepared for human consumption goes as waste that accounts for 1.3 billion tons annually [6]. Usually, food waste contains 69–93% of moisture, 85–96% of volatile solids (VS), and C/N ratio of 14.6–18.3 [5]. Because of the higher moisture content in food waste, biochemical processes like anaerobic digestion are more suitable when compared to thermochemical processes like gasification and combustion [7, 8]. Anaerobic digestion process involves the disintegration and stabilization of

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ENERGY SOURCES, PART A: RECOVERY, UTILIZATION, AND ENVIRONMENTAL EFFECTS
https://doi.org/10.1080/15567036.2020.1771477

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Influence of fatty acid composition on process optimization and characteristics assessment of biodiesel produced from waste animal fat

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ABSTRACT

This present study focus on the process optimization and characteristic assessment of waste animal fat (WAF) biodiesel based on the influence of fatty acids characterized in it. WAFs were rendered from leather fleshing (subcutaneous fat, 85.64%) and slaughterhouse (intramuscular fat, 8.46%) wastes using dry rendering technique, wherein the maximum renderable fat content was found to be 75.77% and 5.89%, respectively. Ethyl esters of oleic acid, palmitic acid, and stearic acid were characterized as dominant fatty acid esters (FAEs) in WAF biodiesel. Optimized transesterification on waste fats using ethanol and synthesized D-valine amido ethyl methyl imidazolium chloride ([D-Vaemim]Cl) as novel ionic liquid (IL) catalyst yielded 97.36% of biodiesel. High molar ratio (WAF to ethanol:6) and reaction temperature (75°C) were accounted by the long-chain fatty acids in triglyceride molecules and their higher degree of saturation, respectively, meanwhile, [D-Vaemim]Cl exhibited high conversion yield beyond 10% and was effective up to 10 cycles. Similarly, biodiesel properties were evaluated as per ASTM D6751 standards, were found to be in acceptable range, and were deeply influenced by carbon chain length and degree of unsaturation in FAE molecules. Also, the presence of long-chain saturated FAEs along with fuel bound oxygen induced superior combustion characteristics and controlled emission concentrations. However, slight reduction in engine performance was due to high viscosity and reduced calorific value of biodiesel which was reflected from its FAE molecules.

ARTICLE HISTORY
Received 23 March 2019
Revised 13 May 2020
Accepted 14 May 2020

KEYWORDS
Waste animal fat (WAF); fatty acid esters; carbon chain length; degree of unsaturation; cetane number; fuel bound oxygen

Introduction

Challenges in addressing the global energy demand due to modern technological advancements and oversize population growth has nearly depleted our planet's fossil fuel reserves. Apart from over-consumption, increased pollution levels associated with their handling and processing have redefined the global climate and atmospheric scenarios putting the entire planet at risk. These potential threats have forced many researchers from various fields to rely on renewable energy resources for addressing this energy demand; and also serve as a replacement for fossil fuel along with reduced or zero emissions into the atmosphere. One such promising renewable energy resource is biodiesel, which

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This article has been republished with minor changes. These changes do not impact the academic content of the article.

JOURNAL OF EXPERIMENTAL & THEORETICAL ARTIFICIAL INTELLIGENCE
https://doi.org/10.1080/0952813X.2019.1652355

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ARTICLE

Check for updates

Spectral feature and optimization- based actor-critic neural network for arrhythmia classification using ECG signal

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ABSTRACT

Arrhythmia classification is an interesting research field that serves as the solution for most of the cardiac-related diseases. The patients with cardiac diseases are experiencing the greatest risk rate of death, and hence, there is a need to identify the presence of arrhythmia in patients to reduce the fatality rate. This paper proposes an arrhythmia classification method, which offers better classification accuracy and releases the time spend for classifying the patients. The proposed method of arrhythmia classification uses the Electrocardiography (ECG) signal to classify the patients with and without arrhythmia. Initially, the wave components are identified from the ECG signal and are subjected to the feature extraction. The spectral and statistical features are extracted from the wave components that yield the texture and the geometric nature of ECG such that classification of ECG becomes effective. The classification is carried out using the Actor-Critic (AC) Neural Network that is trained using the Proposed Taylor-Sine Cosine Algorithm (Taylor-SCA). The Proposed Taylor-SCA algorithm is the integration of Taylor series and SCA. The experimentation is performed using the MIT-BIH Arrhythmia Database, and the experimental results show that the proposed algorithm exhibits the maximum accuracy, sensitivity, and specificity of 0.9545, 0.77, and 0.9375, respectively.

ARTICLE HISTORY
Received 4 October 2018
Accepted 27 July 2019

KEYWORDS
Electrocardiography signal; arrhythmia classification; actor-critic neural network; sine cosine algorithm; Taylor series

Introduction

For the past few decades, Electrocardiography (ECG) plays a significant role in diagnosing the heart diseases such that the ECG signals are analyzed for offering a better diagnosis step by the cardiologists (Raj, Ray, & Shankar, 2016). ECG defines the electrical activity of the heart, and the cardiac health is detected based on the shape of the ECG waveform such that the peak points in the waveform exhibit the diseases of the heart. The bio-signals are non-stationary, and hence, the peak pointers appear random on the time scale. Thus, an effective study is required that enables effective diagnosis of heart diseases using the patterns in the ECG signal. In certain circumstances, the detection of heart disorder based on the symptoms is impossible. This makes it clear that time has to be spent with the ECG signals for several hours to extract the data. The tedious and the time-consuming processes make the diagnosis of heart disease a risky and hectic challenge (Kumar & Inbarani, 2016; Sathishkumar, Thangavel, & Nishama, 2014). At present, half of the population suffers from Cardio Vascular Disease (CVD), and a large percentage of the people are with Arrhythmia (Yang et al., 2017).ECG signals require continuous monitoring (Dipalishende, 2018) irrespective to the time and physical state of the patients (Ali, Haldar, Khan, & Ullah, 2015). Even though somearrhythmia is rare and less harmful, it may sometimes endup with serious cardiac issues (Haldar, Khan, Ali, & Abbas, 2017).

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Received: 3 December 2019 | Revised: 13 June 2020 | Accepted: 17 June 2020

DOI: 10.1002/pip.3315

RESEARCH ARTICLE

PROGRESS IN PHOTOVOLTAICS WILEY

CCGPA-MPPT: Cauchy preferential crossover-based global pollination algorithm for MPPT in photovoltaic system

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Abstract

In general, the photovoltaic (PV) is considered as the best selection among renewable energy resources due to its nonpolluted operation and good flexibility condition. The PV system is affected because of the partial shading conditions (PSCs), which reduce the generated power. During steady-state operating conditions, there occurs a time delay in tracking the Global maximum power point (GMPP) and Local maximum power point (LMPP) under PSCs using the perturb and observe (P&O) method. In order to overcome such shortcomings, this paper proposed a hybrid algorithm with a P&O technique to improve the maximum power point tracking (MPPT) for the PV system under PSC. In addition to this, the P&O technique is utilized to achieve the LMPP in the first section, and the hybrid algorithm is utilized to achieve the GMPP in the second section. Here, the hybrid technique is the integration of Cauchy preferential crossover (CC) with the flower pollination algorithm (FPA). Furthermore, the exploitation ability of the FPA is enhanced by the CC, and the combined hybrid algorithm has the ability to produce the optimal duty cycle for the DC–DC boost converter for MPPT. Then the proposed method will be executed in MATLAB/Simulink model, and it is contrasted with the existing methods such as CC, current sensorless (CS), and FPA, respectively. The experimental results and analysis reveal that the proposed approach provides better performances when compared with several other metaheuristic algorithms.

KEYWORDS

crossover, DC to DC boost converter, global maximum power point, global pollination, local maximum power point, photovoltaic, PSC

1 | INTRODUCTION

Due to the rapid growth and expansion in business as well as the consistently increasing refinement of existing ways of living, the world supply energy is exposed to a huge strain. This wonder creates uncertainties over energy security as well as environmental sustainability.[1,2] Besides, the problem of climatic changes and it is necessary to reduce carbon impressions has added to the solid force for organizations and countries to put resources into elective energy sources, especially renewable energy (RE). Solar energy is a standout among the most vital RE sources, rather than regular unrenewable assets, for example, fuel and coal.[3] Solar energy is spotless, limitless, and free. The primary utilization of photovoltaic (PV) frameworks is said to be a stand-alone (military, street and residential lighting, electric vehicles space applications, and water pumping). Despite these focal points, PV control frameworks, all in all, still could not accomplish the grid parity because of the high initial investment cost.[4]

IET Generation, Transmission & Distribution

Research Article

IET Journals
The Institution of Engineering and Technology

Hybrid control of a multi-area multi-machine power system with FACTS devices using non-linear modelling

ISSN 1751-8687
Received on 31st July 2019
Revised 26th October 2019
Accepted on 10th February 2020
E-First on 15th April 2020
doi: 10.1049/iet-gtd.2019.1165
www.ietdl.org

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Abstract: Generally, the mathematical formulation of the dynamics governing multi-area power systems with Unified Power Flow Controller (UPFC) is a challenging task owing to the presence of both differential and algebraic sub-systems. The proposed research work attempts to integrate the two subsystems by replacing the algebraic subsystem with a differential approximant that leads to a non-linear system of differential equations. Solution of the proposed model with a properly chosen Lyapunov function produce a nonlinear control signal which damps inter-area oscillations effectively. The non-linear control signal is realised using the backstepping method. Moreover, the new formulation enables utilisation of the law for uncertain parameters using the standard parametric feedback form, such that the advantage of such a controller is unaffected by these parameters. In addition to this major contribution, full utilisation of UPFC, by using a lone multi-variable PI controller which eliminates negative interaction between the controllers, is also achieved. Empirical verification of the proposed approach is done by simulating various scenarios with varying degrees of complexity – from dual area power networks to 39 buses New England system. The results of the experiments indicate the efficacy of the method.

Nomenclature

ω_j, δ_j	angular speed and rotor angle of jth generator
ω_o, δ_o	initial values of speed and rotor angle
m	count of generators
M	count of no generator buses
P_{mj}	input mechanical power of jth generator
P_{ej}	synchronous output power of jth generator
D_j	coefficient damping of jth generator
M_j	moment of inertia of jth generator
H	inertia constant
V_j, ϕ_j	voltage and phase angle of jth bus
B_{jk}	reactance elements of admittance matrix
E_{gj}	internal voltage of the jth machine
φ_{SR}	phase angle of Series VSC
φ_{SH}	phase angle of shunt VSC
m_{SR}	amplitude modulation ratio of series VSC
m_{SH}	amplitude modulation ratio of Shunt VSC
V_{dc}	DC- link capacitor voltage
Q_{Lj}, P_{Lj}	reactive and active loads of jth bus

1 Introduction

Electrical networks are operated on the verge of their stability limit owing to environmental and financial constraints. Utilisation of the available transmission corridor capacity is hampered by stability considerations of various sorts like small signal, transient and voltage stability [1, 2]. Excitation control design approach has received tremendous attention as a practical and convenient way to stabilisation of power systems [3, 4] but with incidental negative damping which needs to be addressed [1]. Power system stabiliser (PSS) which can reconcile the contrary exciter performance with stability is a potential solution for the problem [5–7]. However, PSS is far from being a settling solution, as it is marred by insufficient damping in inter-area modes [8], necessitating more efficient solutions.

With high voltage power electronic techniques becoming competitive and having broad area of operation; flexible AC transmission system (FACTS) devices are earning growing acceptance. Hingorani and Gyugyi [9] initiated the basics of FACTS. Static Synchronous Compensator performs well in bus bar voltage management while Static Synchronous Series Compensators can manage power flow effectively. When the two are combined in a single device, we get the unified power flow controller (UPFC). An explanation of the elementary ideas is shown in [10, 11]. The modelling and control of the UPFC were tried out with various approaches. Power injection model in [12, 13] utilises the UPFC real and reactive power into the power network as the control input, ignoring the dynamics of UPFC. The better method for governing the UPFC is to use Proportional-Integral technique if the dynamics of UPFC is considered [14, 15]. In damping oscillations which include multiple modes, PI control is less productive. In such cases, a number of lead-lag blocks have to be employed [16]. This, in turn, makes the simulation more complex. Operating several controllers typically introduce mutual dynamic interactions with closed-loop system instability as their impairing consequence. A smart PID controller was suggested in [17] as a workaround which can achieve stability. It did improve the system in terms of transient stability and voltage stability, but the enhancement was limited. Another drawback was poor performance outcomes when operating point changed from the designed value.

Pradhan *et al.* [18] proposes a strategy that uses the pair non-local and local feedback means in FACTS based damping controller. However, it does not consider the non-linearity nature of the power system. Although designs using back-stepping technique [19] is popular among nonlinear control, the method assumes infinite bus, which is not valid for large systems. Transient energy function based model prediction method proposed in [20], is prone

2

Contents lists available at ScienceDirect

Superlattices and Microstructures

journal homepage: www.elsevier.com/locate/superlattices

A review of blue light emitting diodes for future solid state lighting and visible light communication applications

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ARTICLE INFO

Keywords:
Buried air void photonic crystal (BAVPC)
Electroluminescence (EL)
External quantum efficiency (EQE)
Multiple quantum well (MQW)
Super lattice (SL)

ABSTRACT

This paper reviews the rapid progress being made in the developments of organic/inorganic blue light emitting diodes (LEDs). Blue LEDs exhibits outstanding electrical and optical properties such as low forward driving voltage, high light output power, high brightness and high internal quantum efficiency (IQE). This article highlights the rapid advancements being made in the developments of organic/inorganic blue LEDs over the last five decades, efficiency enhancement techniques, efficiency droop in blue LEDs and the techniques to alleviate efficiency droop, recent developments in flexible blue LEDs, degradation mechanisms and reliability issues in blue LEDs, challenges in fabrication and packaging of blue LEDs and it also throw light on the applications of blue LEDs. Their uniqueness in terms of low forward driving voltage, high light output power and brightness and large modulation bandwidth has fuelled the incorporation of blue LEDs in a wide variety of applications such as visible light communication (VLC), solid state lighting (SSL), cellular phone displays, liquid crystal display backlights, flexible flat panel displays, outdoor full colour displays, indicators, smart TVs, projection displays and implantable biomedical devices.

1. Introduction

The light emitting diodes (LEDs) have been considered as the most promising light sources for the future due to their unique features like environmental friendliness, high efficiency, low voltage operation and low power consumption, high brightness, small size and excellent reliability [1–5]. The world's first semiconductor p-n junction based red LED is invented by Nick Holonyak and S. F. Bevacqua [6]. Logan et al. then developed the first green LED based on nitrogen doped GaP semiconductor p-n junction [7]. The colour and energy emitted by the LEDs depends on the energy band gap (E_g) of the semiconductor that is used to fabricate the LEDs. Semiconductor materials with an E_g of 2.6 eV or larger is essential to develop blue LEDs that can emit a wavelength range from 455 nm to 485 nm [8]. The wide band gap semiconductors that are used to develop blue LEDs should be of direct-transition type. High quality single crystal semiconductors with an E_g of above 2.6 eV are required to develop high brightness blue LEDs. The rapid improvement in the crystal quality of single crystal GaN semiconductor results in the development of high brightness blue LEDs. Zinc Selenide (ZnSe) with an E_g of 2.7 eV, Silicon Carbide (6H–SiC) with an E_g of 3 eV and GaN with an E_g of 3.4 eV have been considered as the most

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https://doi.org/10.1016/j.spmi.2019.106294
Received 6 August 2019; Received in revised form 4 October 2019; Accepted 11 October 2019
Available online 19 October 2019
0749-6036/

JPE 19-3-19

https://doi.org/10.6113/JPE.2019.19.3.815
ISSN(Print): 1598-2092 / ISSN(Online): 2093-4718

Design and Implementation of Instantaneous Power Estimation Algorithm for Unified Power Conditioner

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Abstract

This paper discusses a simple control approach for a Unified Power Conditioner (UPC) system to achieve power quality compensation at the point of common coupling in distribution systems. The proposed Instantaneous Power Estimation Algorithm (IPEA) for shunt and series active power filters uses a simple mathematical concept that reduces the complexity in the design of the controller. The performance of a UPC is verified with a system subjected to voltage distortions, sags/swells and unbalanced loads using MATLAB/SIMULINK. The simulation study shows that a UPC with the proposed control algorithm can effectively compensate for voltage and current harmonics, unbalance and reactive power. The control algorithm is experimentally implemented using dSPACE DS1104 and its effectiveness has been verified.

Key words: Harmonics, Point of common coupling, Power conditioner, Power quality, Series active power filter, Shunt active power filter

I. INTRODUCTION

Recently, there has been a surge in the current and voltage based power quality problems due to the wide use of power electronic controllers and sensitive equipment in the commercial and industrial areas. The alarming rate of growth in controller using power electronic devices in such industries has resulted in power quality disturbances in distribution networks. High precision process industries and critical loads such as computers, microprocessors and medical equipment require an uninterrupted and regulated power supply of a rated magnitude and frequency. Power quality problems have an adverse effect on industries in terms of equipment failure, data loss, commercial loss and so on [1]. Therefore, standards such as IEEE 519-1992, 2014 have been developed to keep power quality within acceptable limits [2]. A number of mitigation techniques have evolved over time to meet these standards.

These mitigation techniques include passive filters, active filters, hybrid filters and custom power devices [3], [4]. Traditional passive filters using passive components provide only fixed compensation [5]. Active power filters [6]-[8] provide compensation for harmonics and introduce reactive components into systems so that power at a unity power factor can be drawn from the grid. Hybrid power filters [9] are a combination of more than one active filter or passive filter to solve the problems of reactive power and harmonics. Active power filters and hybrid power filters are capable of suppressing either voltage or current related power quality issues. The custom power park [10] concept was developed to provide high quality power to customers with critical loads that cannot tolerate variations in power quality levels. Custom power park with compensating custom power devices such as DVRs, static shunt compensators and unified power quality conditioners overcome power quality disturbances such as voltage sag, voltage swell, transients, voltage and current harmonics. It can also provide a solution to the reactive power burden. DVR injects voltage through a series transformer to

Manuscript received Jul. 13, 2018; accepted Feb. 23, 2019
Recommended for publication by Associate Editor Seon-Ju Ahn.
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Received: 11 August 2020 | Revised: 11 December 2020 | Accepted: 17 December 2020

DOI: 10.1002/ima.22537

RESEARCH ARTICLE

WILEY

Early detection of breast malignancy using wavelet features and optimized classifier

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Abstract

Breast cancer considered to be a significant health issue among women. Early detection will ensure the treatment is easier and more successful. Recently, numerous methodologies have developed using medical imaging to investigate breast cancer. This research seeks to build a computer-aided diagnostic (CAD) system to interpret mammograms. The first stage of CAD includes preprocessing, Fuzzy c means based segmentation applied to a localized area. In the second stage of the CAD method, the extraction of the feature is carried out using three distinct wavelet families with decomposition level at 4 and 6. The ANN, SVM, and ELM classifiers are used in the final stage to enable accurate classification. This article proposes ELM with the Grasshopper Optimization Algorithm (ELM-GOA) to adjust the weight between the input and hidden layer to obtain maximum performance at the middle layer. This method adopts mammogram enhancement, optimum image segmentation, wavelet-based feature extraction, and grasshopper optimization algorithm based ELM to ameliorating the accuracy and reducing the computational cost. The result shows that ELM-GOA has precision and sensitivity of 100% and 98% respectively. The CAD system can identify tumors with 99.33 % accuracy.

KEYWORDS

CAD, classification, GOA, mammogram, wavelets

1 | INTRODUCTION

Signal and image processing algorithms have played a pivotal role in the area of science over the last few years.[1] The use of image processing methods in biomedical science is more important. Digital image processing nowadays performs an integral part of healthcare. Image processing is generally split into four main fields: image acquisition, image enhancement, image analysis and image management.[2] The integration of a medical image directly into automated image processing algorithms is difficult as there is a disparity between the physician's elucidation of a diagnostic image and the structure of discrete pixels which form an image in computer algorithms.[3] Hundreds of mammogram tests are reported in diagnosis facilities with the growing onset of awareness of breast cancer. Even in developed countries, there is a disparity between the availability of experts and the number of experts required for mammogram examination. Furthermore, manual classification is tedious and vulnerable to error. It might lead to poor critical results.[4] Computer-assisted diagnostic systems are necessary for diagnosis because of these limitations. These above-mentioned challenges led to the research and design of a high-precision, computer-assisted detection system for breast malignancy diagnosis.

Mammogram images are taken by exposing the human breast area to X-rays. Mammography is a

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Transportation Research Procedia 48 (2020) 3188–3196

Transportation Research Procedia

www.elsevier.com/locate/procedia

World Conference on Transport Research – WCTR 2019, Mumbai, 26-30 May 2019

Effect of geometry on driver heart rate

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Abstract

Driving is a complex task incorporating most of the body organs and sensory system. Coordinated performance of eyes, ears, hands and legs are required in harmony with mental or cerebral actuations. Depending upon the stimulus the cardio vascular performance of a driver varies. The objective of this paper is to model the heart rate kinetics of drivers in response to variation in highway curve geometry. The study was done on 114 horizontal curves of two lane rural highways of Kerala. Heart rates of 30 drivers were collected during their drive along the study stretches. Cross sectional details of curve like radius of curve, length of curve, deflection angle, superelevation, width of road, width of shoulder and available sight distance were measured. Similarly the length of preceding tangent to the curve was also considered. Findings of the study revealed the correlation of sight distance and shoulder width with average heart rate. A nonlinear regression model was proposed based on analysis.

Peer-review under responsibility of the scientific committee of the World Conference on Transport Research – WCTR 2019

Keywords: Heart rate; two-lane rural highway; geometry; driver workload

1. Introduction

Nomenclature

R	radius of horizontal curve in metre
CL	length of horizontal curve in metre
DA	deflection angle of horizontal curve in degrees
WR	width of road in metre
SE	superelevation of horizontal curve
PTL	length of preceding tangent in metre

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Peer-review under responsibility of the scientific committee of the World Conference on Transport Research – WCTR 2019
10.1016/j.trpro.2020.08.163

International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958, Volume-8, Issue- 2C, December 2018

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Feasibility Study of Provision for Exclusive Bus Lanes on Urban Roads

Arathi A R, VincyVerghese

Abstract: ***Optimal use of road transport system is necessary to address the problems like traffic congestion, air pollution and safety. One such way to optimize is by encouraging use of public transport modes (buses) by assigning priority to them. One of the bus preferential treatments is the provision of exclusive lanes for buses on urban roads. The specific aim of this study is mainly to study the feasibility of provision of exclusive bus lanes based on two criteria, based on proportion of travellers using different types of road vehicles and based on the total travellers' time savings in terms of money value due to provision of exclusive bus lane on urban roads. The major work element of this study includes vehicle occupancy survey, vehicle volume and composition survey, income survey and estimation of journey time and journey time savings in terms of money value savings. The provision of exclusive bus lanes on urban roads increases the speed of buses, reduces journey time, saves travel cost and reduces road crashes.***

Index Terms: *Exclusive Bus Lane, Money Value Savings, Vehicle Composition, Windshield Method.*

I. Introduction

Transportation aims at safe and efficient movement of goods and passengers. Faster mobility of goods and passengers is the catalyst for economic growth of a country and this is facilitated by efficient transportation system. In case of road transportation systems, as facility increases, the volume of traffic also increases due to increasing demand for transport, particularly in developing countries like India. Because of the space, financial and material constraints urban road infrastructure cannot be developed beyond a limit and this leads to increase in congestion, pollution and reduction in road safety. Hence, there is a need for an appropriate strategy for optimal use of road transport system to reduce congestion and to increase efficiency of road networks. One way to reduce congestion is by encouraging the travellers to use public transport system (Buses) instead of private transport modes, because public transport system enables mass transit of passengers in fewer vehicles. To bring about a shift in the passenger preferences, the public transport system should be highly efficient and relatively less expansive to attract the travellers from private modes of transport. This goal can be attained by encouraging public transport modes like buses by assigning priority. One of the methods of assigning priority to public transit are by providing exclusive bus lanes.).

Exclusive bus lanes are the lanes restricted only for buses provided in order to speed up the buses, to reduce the interactions between buses and other modes of vehicles and thereby reducing the road crashes.

Revised Manuscript Received on June 23, 2018.

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II. Objectives

By considering the aim of the study, the main objective formulated is to study the general impact of provision of exclusive bus lanes on traffic flow characteristics un-der heterogeneous traffic conditions. To achieve this main objective the subtasks formulated was the following.

1. To develop social criteria based on the proportion of travellers using different modes
2. To develop economic criteria based on the money value of time of travellers using the different modes.

III. Literature Review

Arasan and Vedagiri [1] estimated the probable shift of car users to bus due to the increase in level of service (LOS) after providing exclusive bus lanes on Indian city roads carrying heterogeneous traffic. The increase in LOS was determined using a recently developed simulation model. A mode-choice probability curve to depict the possible modal shift of car users to bus was developed. From the curve, the probability of shift of car users to bus was estimated 0.7 at traffic flow corresponding to level of service C, for an 11 m wide road and 0.28 for 14.5 m wide road. Arasan and Vedagiri [2] developed and used a heterogeneous traffic flow micro-simulation model to study the impact of provision of reserved bus lanes on urban roads in terms of reduction in speed of other categories of motor vehicles due to the consequent reduction in road space, over a wide range of traffic volume. It has been found that the maximum permissible volume to capacity ratio that will ensure a LOS C was 0.62 for the traffic stream other than buses if the bus lane is provided. Justification of providing exclusive bus lane has also been defined on the basis of number of travellers per unit width of the road. Cevero [3] developed working paper on Bus Rapid Transit (BRT): An efficient and competitive mode of public transport. This report reviews experiences with designing and implementing BRT systems worldwide. BRT is first defined across a spectrum of service qualities and costs. The report closes with discussions on BRT's likely future given global growth projections and other pressing policy agendas in the foreseeable future. Chen et al. [4] carried out a study to examine the effect of exclusive bus lanes (XBLs) and transit signal priority (TSP) on bus rapid

International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958, Volume-8, Issue- 4C, December 2018

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Environmental Impact Assessment of Thrissur-Vadanapally Road Project

Rosmy Sebastian, Vincy Verghese, Cyriac M. G.

Abstract*—Environmental impact assessment (EIA) for transportation projects has an integral role in environmental management schemes. All the road works and other transportation infrastructure development programs creates significant impact on various aspects of life. Impacts can be positive or negative. Here an EIA is conducted to study the socio-economic impacts and bio-physical impacts of widening of Thrissur - Vadanapally road project and evaluation of the same. The impact prediction is done by means of good fit models for the existing conditions. Gaussian air dispersion model, CRTN Model for traffic noise, Mass Balance and Streeter- Phelps Equation for water quality analysis were used. With the help of these models, the prediction is done accurately. The predicted impact includes the meteorological and climatic impacts, noise quality, water quality, air quality and social impacts. Water quality changes rises only when there is change in drainage pattern occurs. These change is modelled using the Streeter Phelps equation and the mass balance equations. Air quality modelling was done using the Gaussian dispersion model and the impact of traffic noise was done using the CRTN Models. The air and noise values at the present condition was greater than the prescribed norms of pollution control board. The air quality issues are predominant at distances nearer to the source, as the distance increases the effect of air pollution also decreases. Various mitigation measures are suggested for reducing the impacts predicted or to avoid the impact in each stage of construction.

***Index Terms*—Environmental impact assessment, impact modelling, impact prediction, mitigation measures.**

I. INTRODUCTION

Recent environmental issues that has developed due to Urbanization with special effects on the environment has led to the process called Environmental Impact Assessment (EIA) which can be defined as "the need to identify and predict impacts on the environment and on man's wellbeing of legislative proposals, policies, programs, projects and procedures and to interpreter and communicate information about the impacts". Since the introduction of EIA over 30 years ago, the possible profits has been widely recognized and it has been adopted and implemented in more than 100 countries by numerous aid and funding agencies .In essence, EIA is a process that assesses the impact of developments on the environment in an efficient, universal and multidisciplinary way taking into consideration all environmental components. EIA as a process involves a number of steps which are as follows: [3]

- Description of project
- Screening
- Scoping/consideration of alternatives
- Baseline studies public consultation and participation
- Impact prediction
- Preparation of Environmental Impact Statement(EIS)
- Decision making
- Post decision making and monitoring

A. Objectives

The main objective of the study is identified as to predict and evaluate impacts of a road project.

To achieve the main objective of predicting and evaluating the impacts of a road project involves following subtasks:

- Impact prediction using good fit models
- Suggesting mitigation measures for impacts predicted

II. LITERATURE REVIEW

Environmental impact assessment (EIA) is a planning tool for predicting the impacts on the environment from altering or building a new establishment. For the purposes of EIA, the meaning of environment incorporates physical, biological, cultural, economic and social factors. Over the last three decades, environmental impact assessment (EIA) or environmental assessment (EA) has become a major tool for effective environmental management. Over the years, the focus of EA has changed towards making it a useful tool for environmental sustainability, which can be very effectively put to use to ensure that all important factors are included and unnecessary factors are revealed and dropped. Generallyhighway projects are undertaken in order to improve the social and economic life of the people. But they may also have an adverse impact on the surrounding environment. Most affected people and property are those in the direct path of the road works. Damage to sensitive eco-systems, changes to drainage pattern and thereby groundwater, soil erosion, interference with animal and plant life, resettlement of people, demographic changes, loss of productive agricultural lands, , accelerated urbanization, disruption of local economic activities, and increase in air pollution are some of the impacts of highway projects. Highway development and construction should be planned with careful attention towards the environmental impacts.

Manuscript received June 23 2018.

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International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958, Volume-8, Issue- 4C, December 2018

29

Use of Data Mining Technique for Systematic Road Safety Audit of Non-urban Highways

Bincy B.J, Anitha Jacob

Abstract*— In India the number of road crashes is raising at frightening rate. There is one death in every four minutes due to road crashes in India. Hence it is necessary to improve the road safety by conducting a detailed Road Safety Audit (RSA) in order to identify road safety issues and to make necessary improvements. Budgetary constraints limit many developing countries from performing the audit on regular basis. This will eventually delay any rehabilitation or repair process making the road conditions the worst and risky. This paper proposes a systematic approach to do the road safety audit on a highway and to do effective and efficient data mining, for deriving knowledge driven decisions in the classification of highway sections. The approach will help to perform safety evaluation of sections and to identify the crash potential locations. Further output of the work is the development of a mathematical model for classification of highway sections based on road safety audit.

Index Terms*— Data mining, Weka, Road Safety Audit, Road safety model

I. INTRODUCTION

Road Safety Audit (RSA) is method of evaluating the safety performance of a road by an independent team or trained specialties. Qualitative estimation on potential road safety issues, identification of opportunities for improvements and ensure safety for all road users are the basic objectives of RSA. Government incorporate RSAs into the initial stage of the project such as construction of new roads and intersections, and also encourages RSAs on existing roads and intersections. Thereby all the new and reconstructed roads can be made safe as possible. Since RSA is done based on a clearly defined procedure it can be used at any progressing stages of project. The principles of RSA can be applied throughout the highway project development in order to ensure a growing awareness about road safety principles. Traffic control devices provide safe and secure journey for the road users. These are devices used to inform, guide and control the traffic. Maintenance of traffic control devices is one of the most important aspects of highway management systems. Scientific and well-timed installation of the traffic control devices increases safety as well as significantly decreasing accident rates. For a safer driving environment, timely maintenance of the traffic signs is very important and incorporating these activities makes a viable economic sense. The specialized units of highway authorities that is the Road Safety Authority (RSA) frequently check the safety requirements of the traffic control devices.

Road Safety Audit can minimize the risk and severity of road accidents by the road project and also can minimize the need of remedial work after construction. Road safety inspection based on (IRC SP – 88, 2010) [9] is conducted on an existing road, from Kunnamkulam to Peramangalam, since it is identified as one of the accident black spot.

II. 11. LITERATURE REVIEW

This section, describe a short survey about Road Safety Audit, and classification of road by means of Weka software and analysis

A. Road Safety Audit (RSA)

Road safety audit is done to ensure the operational safety performance of a road. Hence, it has the potential for improving safety when it is applied to a road or traffic design before the project is implemented. Through RSA the identification of potential safety hazards on new road projects at the appropriate stage can be done and so that it can minimize the adverse effects at minimum cost. It can be conducted on any design proposal, which involves changes to the ways road users will interact, either with each other or with their physical environment. Purpose of the audit is to identify hazardous features on existing road so that it can be eliminated or otherwise treated before they become an accident prone location. Mehar and Agarwal [2] presented a systematic approach to improve the road safety by analyzing the crash records thus by identifying the most hazardous locations of the study area. They also describes the difficulties faced in the safety audits and analysis of accidents. They developed a hierarchical frame work for the improvement of road safety. Based on the crash rate safety hazardous locations were identified and ranking is done. They also suggest suitable remedial measures to improve the hazardous locations. Saffarzadeh and Farshad [3] studied the maintenance of highway traffic control device and the problems faced, they found that in many developing countries, due to budget limits and lack of regular maintenance activities and many deficiencies related to signs, guardrails road markings increased. They also tried to propose an appropriate management system for the maintenance of traffic control devices, along with the development of computer software for control devices, which can identifying the necessary time for maintenance.

Manuscript received June 23 2018.

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International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958, Volume-8, Issue- 4C, December 2018

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Activity Based Transportation Modeling for Chelakottukara ward of Thrissur District

Midhun T, Anitha Jacob

Abstract: ***An Activity-based model is the one that generally replaces the conventional trip-based model, which is usually represented to as the four-step model. With the variations in the transportation system attributes and changes in socio-demographics of the individuals, the transportation planners and engineers' need to have the ability to estimate the variations in transportation demand so as to make a well-versed transportation infrastructure planning decision possible. Activity-based models are used for this purpose; these models are used to forecast travel characteristics and usage of transport services under different socio-economic scenarios. An activity-based travel pattern model has been developed for the individuals of the study area. This activity-travel pattern model will take different input parameters such as various land-use, socio-demographic, activity system, and transportation level-of-service attributes. Thus it will provide the activity-travel pattern of each individual in the study area as the output, within the continuous time domain.***

Index Terms: ***Activity-Based Travel Pattern, Four-Step Model, Socio-Economic, Travel Demand.***

I. INTRODUCTION

Transportation plays an important role in the growth and economy of a nation. For a country like India, transportation planning is becoming unavoidable due to the fast-growing population and travel demand. Transportation planners and engineers have to be able to forecast the response of transportation demand for the changes in the attributes of the transportation system and changes in the socio-demographics of the people using the transportation system in order to make informed transportation infrastructure planning decisions. Travel-demand models are used for this purpose. It is used to predict the travel characteristics and the use of transport services under various socioeconomic scenarios and for various transport service and land-use configurations.

The mathematical relationship between travel demand and traveler and system characteristics can be achieved with the help of travel demand modeling. Earlier travel demand modeling is done with the help of trip based four-step modeling – as the trip generation, trip distribution, mode choice and route choice. This four-step modeling is said to be conventional modeling. Later on, new generation models such as tour based and activity based models emerged overcoming most of the drawbacks of the conventional method. The tour based approach considers a chain of trips starting and ending at the same location as the individual unit of analysis whereas activity-based travel demand model considers travel as a derived demand to satisfy the need of the individual [1]. The objective of this paper is to develop an activity-based travel demand model for Chelakottukara, the 22nd ward of the Thrissur City of Kerala, taking into consideration of the socio-economic factors and travel pattern, validating the generated model and suggesting how it can be made beneficial in the planning process. It includes a tour generation model for both single and complex activities.

II. LITERATURE REVIEW

A. Trip-Based Models

Trip-based travel models have evolved over many decades. As their name suggests, trip-based models use the individual person trip as the fundamental unit of analysis. Trip-based models are widely used in practice to support regional, sub-regional, and project-level transportation analysis and decision making. Trip-based models are often referred to as "4-step" models because they commonly include four primary components. The first trip generation components estimate the numbers of trips produced by and attracted to each zone (these zones collectively represent the geography of the modelled area). The second trip distribution step connects where trips are produced and where they are attracted to. The third mode choice step determines the travel mode, such as automobile or transit, used for each trip, while the fourth assignment step predicts the specific network facilities or routes used for each trip[8].

B. Activity-Based Models

Activity-based models are having some similarities to traditional 4-step models: activities are generated, destinations for the activities are identified, travel modes are determined, and the specific network facilities or routes used for each trip are predicted. However, activity-based models incorporate some remarkable advances over 4-step trip-based models, such as the clear representation of realistic constraints of time and space and the linkages among activities and travel, for an individual person as well as across multiple persons in a household. These linkages enable them to more sensibly represent the effect of travel conditions on activity and travel choices.

Manuscript received June 23, 2018.

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Journal of Medical Systems (2019) 43:240
https://doi.org/10.1007/s10916-019-1370-x

IMAGE & SIGNAL PROCESSING

Check for updates

Medical Image Enhancement by a Bilateral Filter Using Optimization Technique

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Received: 12 March 2019 / Accepted: 5 June 2019

Abstract

For researchers, denoising of Magnetic Resonance (MR) image is a greatest challenge in digital image processing. In this paper, the impulse noise and Rician noise in the medical MR images are removed by using Bilateral Filter (BF). The novel approaches are presented in this paper; Enhanced grasshopper optimization algorithm (EGOA) is used to optimize the BF parameters. To simulate the medical MR images (with different variances), the impulse and Rician noises are added. The EGOA is applied to the noisy image in searching regions of window size, spatial and intensity domain to obtain the filter parameters optimally. The PSNR is taken as fitness value for optimization. We examined the proposed technique results with other MR images After the optimal parameters assurance. In order to comprehend the BF parameters selection importance, the results of proposed denoising method is contrasted with other previously used BFs, genetic algorithm (GA), gravitational search algorithm (GSA) using the quality metrics such as signal-to-noise ratio (SNR), structural similarity index metric (SSIM), mean squared error (MSE), and PSNR. The outcome shows that the EOGA method with BF shows good results than the earlier methods in both edge preservation and noise elimination from medical MR images. The experimental results demonstrate the performance of the proposed method with the accuracy, computational time, and maximum deviation, Peak Signal to Noise Ratio (PSNR), MSE, SSIM, and entropy values of MR images over the existing methods.

Keywords Bilateral filter · Rician and impulse noise · SNR · EGOA · Genetic algorithm · Noise elimination

Introduction

The medical image created by MRI, CT, X-ray and ultrasound assumes an essential part in the identification of diseases [1]. The distinguishing proof, examination and treatment of infections are influenced by the noises introduce in the image [2]. The noises are delivered in the images at the time of transmission and procurement because of the ecological conditions and obstruction in the channel. The temperature variations of the sensor additionally create noises [3]. The denoising of medical image is essential for the diagnosis and treatment planning process. As of late the images are caught utilizing the digital system. The evacuation of noises in the digital image is a troublesome errand [1]. The noises decrease the nature of the image. The sort of the noise ought to be distinguished and its statistical properties ought to be examined for the denoising procedure [4]. Different kinds of noises, for example, Gaussian noise, Rayleigh noise impulse noise are delivered amid the image acquisition process. The Gaussian noise and Rayleigh noise are produced amid sampling and transmission. The impulse noise is additionally called as salt and pepper noise. It happens in the image as black and white specks [5, 6]. Add up to variation filter, changing domain filter and gradient technique is a portion of the strategies utilized for image denoising. Add up to variation filters and change domain filters are influenced by finished smoothing impact [7, 8].

The noise named as Rician noise which is delivered in the MR images are evacuated utilizing the fuzzy hybrid filter. The Rician noises in the images influence the post handling procedures like segmentation and parametric synthesis [9]. The speckle noise in the ultrasound medical image is diminished

This article is part of the Topical Collection on *Image & Signal Processing*

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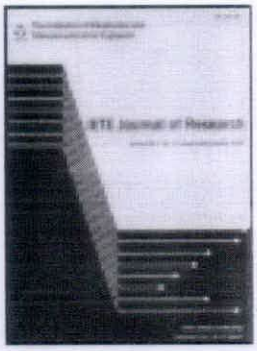
Published online: 20 June 2019



IETE Journal of Research

ISSN: 0377-2063 (Print) 0974-780X (Online) Journal homepage: http://www.tandfonline.com/loi/tijr20

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Investigation of RF and DC Performance of E-Mode $In_{0.80}Ga_{0.20}As/InAs/In_{0.80}Ga_{0.20}as$ Channel based DG-HEMTs for Future Submillimetre Wave and THz Applications

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To cite this article: J. Ajayan, T. Ravichandran, P. Mohankumar, P. Prajoon, J. Charles Pravin & D. Nirmal (2018): Investigation of RF and DC Performance of E-Mode $In_{0.80}Ga_{0.20}As/InAs/In_{0.80}Ga_{0.20}as$ Channel based DG-HEMTs for Future Submillimetre Wave and THz Applications, IETE Journal of Research, DOI: 10.1080/03772063.2018.1553641

To link to this article: https://doi.org/10.1080/03772063.2018.1553641

Published online: 09 Dec 2018.

Results in Physics 13 (2019) 102140

Contents lists available at ScienceDirect

Results in Physics

journal homepage: www.elsevier.com/locate/rinp

Microarticle

Numerical analysis of circularly polarized modes in coreless photonic crystal fiber

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ARTICLE INFO

Keywords:
Coreless
Twist
Circular polarization
Finite element method

ABSTRACT

In this paper, the coreless photonic crystal fiber (CO-PCF) is investigated using finite element. The absence of core in the PCF structure is achieved by applying the permanent twist on its cladding boundary and hence the light propagation path tends to be circularly polarized. The other modes can also be exerted other than the fundamental modes is known as cladding filled modes or super modes.

Introduction

In modern optics, the different mechanism of light propagation has been followed. The main features of the light manipulation are referred as polarization [1]. Sofar, many researchers have investigated various polarizations such as liner polarization, elliptical polarization and circular polarization. Among the different types of polarized waves, the circular polarization is considered and preferred for all other better applications of photonics. The same thought has been extended to the special kind of fiber known as Photonic crystal fiber (PCF) [2] which act as deserved candidates for photonic society in various aspects such as Sensing [3,4], THz devices [5] etc. Further, the PCF is supposed for generating the circular polarization which could be done by applying the permanent twist on its cladding boundary and called as coreless PCF

Design and modes calculation

The cross section view of the (CO-PCF) and its mode distribution are shown in Fig. 1. The dimension has been followed by [6] and the permanent twist is applied by the given matrix Eq. (1). The application of stress on the cladding region induces the six spoke effect as shown in Fig. 1(b) such that the cladding region is formed by six layers of hexagonal shape and it exhibits the flower pattern with six wings in a circular pattern. Hence it is said to be circular polarization. The cladding modes other than the fundamental modes are known as super modes which would be considered for many prominent applications. The tensor matrix to induce the circularly polarized medium over the length of PCF is given by [6],

$$T^{-1} = \begin{bmatrix} (\alpha^2x^2 + 1) & \alpha^2xy & -\alpha y \\ \alpha^2xy & (\alpha^2y^2 + 1) & \alpha x \\ -\alpha y & \alpha x & 1 \end{bmatrix} \quad (1)$$

Conclusion

This paper has given the method of inducing circular polarization using coreless photonic crystal fiber (CO-PCF). The mode distribution of the fundamental mode for left and right rotation is numerically simulated. Also, the cladding modes or super modes were exhibited to shown the property of CO-PCF. This entire mode pattern with circularly path was achieved by applying permanent twist on its cladding boundary.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rinp.2019.02.076.

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https://doi.org/10.1016/j.rinp.2019.02.076
Received 13 February 2019; Received in revised form 22 February 2019; Accepted 22 February 2019
Available online 26 February 2019

Contents lists available at ScienceDirect

Results in Physics

journal homepage: www.elsevier.com/locate/rinp

Microarticle

Exploring magnetic fluid sensor using dual circular core elliptical cladding photonic crystal fiber

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ARTICLE INFO

Keywords:
Magnetic fluid
Finite element method (FEM)
Spectral shift
Photonic crystal fiber (PCF)

ABSTRACT

The work deals the sensing mechanism of magnetic fluid for various magnetic field strength (Oe). The sensing medium is infiltrated in the given hollow circular hollow channel of photonic crystal fiber(PCF). Using finite element method (FEM), the light interaction between magnetic fluid and silica glass is numerically investigated. By calculating the spectral shift of resonance wavelength for 100 Oe, 120 Oe, 140 Oe and 160 Oe, the sensitivity of the proposed design is achieved.

Introduction

In modern optics, optical sensor has attained more impact as it scaling size in micro range. Particularly, PCF is highly deserved to proposed various kind of sensor such pressure sensor [1], temperature sensor [2], glucose sensor [3], Refractive index sensor [4], salinity sensor [5], blood plasma sensor [6]. In this work, photonic crystal fiber based magnetic fluid is investigated using FEM and its spectral shift decides the sensitivity of magnetic field strength (Oe). The refractive index of magnetic fluid is taken from [7].

Design and numerical investigation

Fig. 1 shows the cross section view of the 2D magnetic field sensor. The dimensions are d, P, r1x, r1y are properly chosen as 1 μm, 2 μm, 0.7 μm, 0.5 μm respectively. The analytes is infiltrated in the blue region.

Fig. 2 shows mode distributions for the proposed structure such as even and odd mode for X and Y- polarization. Fig. 3portrays the transmission spectrum for different magnetic fluid. The arrows show the electric field distribution in different directions.

The sensitivity is reported by taking the slope spectra shift and peak wavelength for 160 Oe noted as 1440.3*nm*, 1440 *nm* with sensitivity of 3125 nm/[*RIU*]for X-polarization and 2500 nm/[*RIU*] for y-polarization respectively.

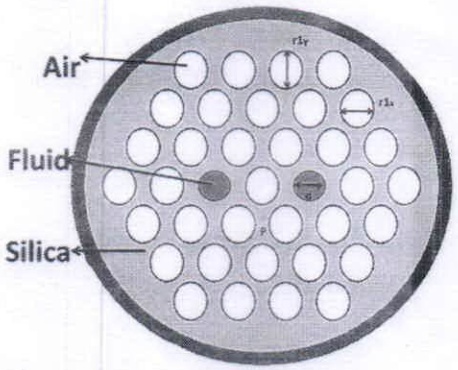

Fig. 1. Cross sectional view of magnetic sensor PCF.

Conclusion

The proposed work is for sensing the various magnetic field strength (Oe). The sensitivity of X-polarization has greater than the Y-polarization such as 3125 nm/[*RIU*] and 2500 nm/[*RIU*] respectively. All the numerical simulations were performed by finite element method (FEM)

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https://doi.org/10.1016/j.rinp.2019.102216
Received 26 February 2019; Received in revised form 19 March 2019; Accepted 20 March 2019
Available online 23 March 2019

JINST

PUBLISHED BY IOP PUBLISHING FOR SISSA MEDIALAB

RECEIVED: *January 29, 2019*
REVISED: *April 28, 2019*
ACCEPTED: *May 3, 2019*
PUBLISHED: *May 30, 2019*

TECHNICAL REPORT

Evaluation of various benchmark processes with appropriate controller design in LabVIEW platform

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ABSTRACT: Engineering education needs simulation studies and it is the best way of understanding engineering concepts with minimal cost and energy. The main focus of this present work is to provide a workspace especially in LabVIEW for analyzing the performance of the system and to operate them in stable and controlled regions. LabVIEW is a simulation platform which facilitates the simulation of various systems and their response with various controllers programmed using functional blocks that are easy to understand. In this work, the benchmark test systems like DC series motor as first order system, general second order system and a Real time rotary Inverted Pendulum (RIP) model which has been reduced with high order system reduction technique are considered. The test systems are controlled with PID controller tuned by various tuning methods. The PID controller is tuned with conventional methods like Ziegler-Nichols (ZN), Internal Model Control (IMC), and Direct Synthesis (DS) and the responses of the systems are analysed in LabVIEW platform. The common platform has been developed and tested for supporting the performance and analysis of the system with adjustable PID controller parameters like proportional gain K_p, integral time constant T_i, and derivative time constant T_d. The performance specifications are phase margin, gain margin, bandwidth, settling time, rise time and integral errors. This LabVIEW platform facilitates the learners to analyze the system effectively with various controllers and their performance parameters are compared easily.

KEYWORDS: Control systems; Overall mechanics design (support structures and materials, vibration analysis etc); Voltage distributions

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https://doi.org/10.1088/1748-0221/14/05/T05008

AMERICAN SCIENTIFIC PUBLISHERS

Journal of Medical Imaging and Health Informatics
Vol. 8, 1–13, 2018

Evaluation Strategies for Wireless Ultra Wideband Communication Towards Orthopedic Surgical Scheme

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Wireless medical devices shall considerably improve the proficiency and effectiveness in medical segments. Recent wireless inventions enable reduced design, thus becomes inexpensive for manufacturing. Huge quantity of individual information is measured and communicated in wireless manner, consequently safety precautions are needed to be integrated with these wireless technologies. The evaluation strategies for Wireless Ultra Wideband communication towards orthopedic surgical scheme has been explained in this paper. Every devices considered in this paper are identical with each others towards their elementary objective. However, they vary towards different real-world applications. The devices enumerated in this paper have shared operating frequency bands of 2.4 GHz ISM Band and UWB frequency ranging from 3.1 GHz to 10.6 GHz. Every devices entailed here is positioned to fit within the operating frequencies either at 2.4 GHz or 3.1 GHz to 10.6 GHz. This paper targets on protective patient-privacy which is deemed to be energetic characteristics towards isolated patient monitoring schemes. Considering the rise in quantity of feasible wireless medicinal products, this paper targets in the engagement of different wireless standards and measured data on the basis of dissimilar rates. Thus, the foremost significant in this work is towards supplementing the quantity of integration in wireless medical monitoring schemes. Similarly, as the applications of implantable and ingestible wireless medical approaches are becoming increased, they offer easy accessing towards data collecting and data which are previously dreadful, and this has been considered as a vital parameter in this paper. Hence, there becomes bigger possibility towards improving exactness of wireless positioning arrangements. When complications of the system increase, the prevailing protocols shall not be appropriate for superior and satisfactory bandwidth pertaining real-time application, thereby few protocols have been worked out to encounter this issue. Therefore, the major contributions in this paper include advanced speediness, superior data rate designs and effective protocols. In this paper, all the structures entailed have the potential to assist doctors for improving the dominance in lives of patients, thus application development is properly discussed for progressing with these implements.

Keywords: Wireless Medical Device, Medical Testing, Medical Imaging, Orthopedics, Monitoring Systems, Computer Aided Surgery, Wireless Medical Devices, Wireless Technologies.

1. INTRODUCTION

Ultra-wideband (UWB) technologies are employed in recent medical devices because of their lower likelihood in detecting radar systems.[1] Attention towards UWB for exclusive wideband communication and placing them has risen steeply when Federal Communications Commission (FCC) liberated their notification of inquiries during 1998, as enumerated by R. Chávez-Santiago et al.[8] The representation of a characteristic wideband locating system, in which four or more base station triangulates these 3D position for mobile tags, thereby reference tags are considered to offer location and orientation point towards global coordinate frames (Fig. 1). At this point, the base station (BS) is linked with master processing units, thereby reference tags are necessary for bringing mobile tags towards 3D global coordinate structure. 3D triangulation shared with cutting-edge discovery in UWB receivers helped in mitigating severe necessities required at base station management and alternating sensitivity towards denser interior multipath interference [illegible]. Though this system entailed [illegible] but since it is executed with [illegible]

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MATERIALS RESEARCH INNOVATIONS
https://doi.org/10.1080/14328917.2018.1512736

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Corrosion of reinforcement in concrete with fly ash and manufactured sand

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ABSTRACT

This research article reports the comprehensive experimental studies conducted on the identification of corrosion mechanism. The study is made in two different types of samples taken from reinforced concrete containing class–F Fly ash and steel bar with different fine aggregates such as river sand and manufactured sand. It also reports the study under different curing conditions to find out corrosion attack on fly ash concrete structure. Cement placed by means of Fly ash, concrete mixes prepared with 20%, 30%, 40% weight of cement and using16mm diameter steel bar 100mm length with 25 mm clear cover were used as samples. Corrosion process was investigated in embedded steel bar by using Tafel polarization and AC Impedance methods by using ACM Instruments (UK).This study will help in identifying the level of corrosion between the usage of river sand and the manufactured sand.

ARTICLE HISTORY
Received 11 June 2018
Accepted 13 August 2018

KEYWORDS
Concrete; corrosion; curing; fly ash; impedance; polarization

1. Introduction

Corrosion is the process by which a metal or an alloy deteriorates, because of oxidation, a chemical action that creates iron oxides and that flake away from the base [1]. Corrosion of concrete means degradation of concrete such as spots, cracks, spalling that lead to the loss of strength and dimensions of the concrete member due to corrosion of steel reinforcement embedded in concrete [2,3]. The steel reinforcement in fly ash concrete has received an increasing attention in recent years. Because of fly ash availability in cheaper cost, much more quantity is used in construction Industry. Fly ash is a byproduct of the coal fired thermal power plant which has the combination of (Anthracite, Bituminous-class F), (Lignite, sub bituminous–class C).

Fly ash is generally captured by electrostatic precipitators (ESP) before the flue gases reach the chimney which is well accepted as a pozzolonic material used either as a component of ordinary Portland cementor as a mineral admixture in concrete [4]. Fly ash is excellent void filler than Portland cement in concrete . The cost of fly ash is cheaper than OPC. The chemical composition of fly ash consists of 95% to 99% of oxides of silicon, aluminum, calcium in the form of Silicon Oxides (SiO_2), Aluminum Oxides (Al_2O_3), and Calcium Oxides (CaO), Iron Oxides (Fe_2O_3), remaining of trace elements. Carbon content in the fly ash is measured by the Loss on Ignition (LOI). Fly ash occurs as very fine particle having an average diameter less than 10μm with solid and hollow spheres in shape, and have high surface area 300 to 500 sq.m/kg, specific gravity between 1.9 to 2.8, low to medium bulk density 540 to 860 kg/cum without compaction, and 1120 to 1500 kg/cum with compaction and very light texture grey or tan in color.

The quality of fly ash varies depending on the quality of coal which is being used and also depends on the operating condition of the thermal power plant. The main reason for corrosion in fly ash concrete is combination of the mixture of chloride iron (Cl^-)and carbonization [5]. The corrosion of reinforcement in fly ash concrete is the electrochemical process with the presence of oxygen and water [6, 7]. The high alkaline environment (pH>11) protects the steel reinforcement from corrosion. The factors that affect the rate and level of corrosion are pH of the concrete pore water, crack in the concrete, carbonization of cement paste, stray current, design features of concrete, mixture proportions of the concrete, thickness of concrete, concrete cover, and galvanic effect. The concrete deterioration occurs due to rust (Ferric oxides and Ferric hydroxides) formed at the interface between reinforcement and concrete with the rust volume of 3 to 6 times more than Fe iron. Rust creates internal stresses in concrete member [8,9]. Due to Internal stresses cracks will form on the surface of concrete which subsequently damage the concrete structure that finally lead to the collapse of the entire concrete structure. The major contributions behind our work are as follows:

- An experimental study are made on the identification of corrosion mechanism in different types of reinforced concrete containing class – *F*Fly ash and steel bar with different fine aggregates such as river sand and manufactured sand.
- Analyzes is done in different curing conditions to find out corrosion attack on fly ash concrete structure.
- Investigation is carried out the corrosion process in embedded steel bar by using Tafel polarization and AC Impedance methods by using ACM Instruments (UK).
- Inference from the study is carried out such as Tafel polarization and AC Impedance the test results obtained shows 1% to 2%variations.

The rest of this work is summarized as follows: Section 2 demonstrates the materials and methods used in this experimental study. Section 3 describes the methodology of corrosion steel mechanism. Section 4 exhibits the experimental

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Journal of Thermal Analysis and Calorimetry (2019) 136:185–197
https://doi.org/10.1007/s10973-018-7791-9

15

Energy and exergy analysis, drying kinetics, modeling and quality parameters of microwave-dried turmeric slices

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Received: 30 May 2018 / Accepted: 5 October 2018 / Published online: 19 October 2018

Abstract

The aim of this study was to evaluate the effect of curing and microwave power levels on energy analysis, drying characteristics, modeling and quality parameters of turmeric slices in microwave dryer. Drying experiments were carried out for fresh and cured turmeric slices. Four microwave power levels of 30%, 50%, 80% and 100% with the total output power of 900 W were used for this study. From the drying rate curve, it was observed that the drying process mainly takes place in the warming up and falling rate periods. Among the eight models evaluated in the study, Midilli et al. and Page model had a good agreement with the experimental data. Moisture diffusivity values increased (1.83×10^{-08} to 1.59×10^{-07} m^2/s) as the microwave power level increases. From the energy analysis, it was found that specific moisture extraction rate and specific energy consumption values varied in the range of 0.146–0.395 kg/kWh and 9.1093–24.6093 MJ/kg, respectively. Energy efficiency values (9.24–24.75%) were found to be higher than the exergy efficiency values (2.18–12.77%). Quality parameters such as color value and curcumin content of the fresh samples were found to be higher when compared to cured samples. SEM analysis revealed the porous internal structure of the dried samples. From this study, it is revealed that curing of turmeric slices has negligible effect on the parameters analyzed. A moderate microwave power level would be suitable for turmeric drying to produce high-quality product with lesser energy consumption.

Keywords Microwave drying · Drying kinetics · Energy and exergy analysis · Modeling · Quality parameters

Introduction

Turmeric, an Indian spice (Curcuma Longa), is a perennial rhizomatous erect herb from the *Zingiberaceae* family which belongs to the class of *Monocotyledons* [1]. The bright yellow color of turmeric is due to the presence of fat-soluble, polyphenolic pigments known as curcuminoids. Curcumin is the principal curcuminoid compound along with demethoxycurcumin and bisdemethoxycurcumin. Apart from the use of turmeric as a spice and coloring agent, it has anti-inflammatory and anticancer activities with high potential to prevent and treat various diseases [2]. Among the various preservation techniques employed in agricultural processing, drying is one of the oldest and most commonly used method. In India, most of the post-harvest losses of the agricultural products are mainly due to the lack of efficient drying techniques [3]. Drying is an important unit operation that forms an integral part of many food processing systems. Sun drying is the most commonly used method for drying of turmeric fingers for powder production and storage. Even though this method has an advantage of utilizing the cheapest source of energy from sun, it has some limitations such as long drying time (10–15 days), non-uniformity in product quality, post-harvest losses by insects and birds and chances for microbial attack due to its higher initial moisture content (70–80%). Alternative to the sun drying method evolved the mechanical air dryers with higher product quality and lower energy efficiency. Singh et al. [4] evaluated the mechanical air drying of turmeric rhizomes at various temperatures and air velocities. They found that better

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Fuel 246 (2019) 69–74

Contents lists available at ScienceDirect

Fuel

journal homepage: www.elsevier.com/locate/fuel

Full Length Article

Experimental investigation on performance, combustion and emission analysis of a direct injection diesel engine fuelled with rapeseed oil biodiesel

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ARTICLE INFO

Keywords:
Rapeseed oil
Diesel engine
Combustion
Emission
Biodiesel

ABSTRACT

Depletion of fossil fuel resources and continuous release of greenhouse gasses to the environment forces the researchers to develop alternative fuel technologies that are environmentally more acceptable. Trans-esterified vegetable oil derivatives also called 'biodiesel' appear to be the most convenient method of utilizing bio-origin vegetable oils as replacement fuels in diesel engines. In the present study, biodiesel was prepared from non-edible rapeseed oil through the *trans*-esterification process and the property of biodiesel was compared with standard diesel fuel. The methyl esters of vegetable oils cope well with the existing engine hardware and do not require noticeable modification. Experiments were carried out to analyse the performance, combustion and emission characteristics of a four stroke, single cylinder 5.95 kW, direct injection diesel engine fuelled with diesel, rapeseed oil biodiesel and diesel–biodiesel blends at a constant injection pressure of 200 bar. The performance parameters such as brake thermal efficiency, brake specific energy consumption, exhaust gas temperature and combustion characteristics such as in-cylinder pressure, heat release and ignition delay of the engine were evaluated. Unburned hydrocarbon, carbon monoxide, oxides of nitrogen and smoke emission of the engine were also measured for all the test fuels. The results of the experimental investigation with biodiesel blends were compared with that of baseline diesel. The test results revealed that B25 blend can be used in the diesel without making any modification in the engine with acceptable thermal efficiency and improved exhaust emissions.

1. Introduction

Energy consumption is growing exponentially due to rapid progress in the living standards of mankind. Nowadays, the fossil fuels play a major role in the mobility, industrial sectors, and agricultural sectors. Meanwhile, the availability of petroleum resources is limited in nature and they are getting depleted day by day [1–3]. Furthermore, problems related to the environment are the most important consequences of consumption of more fossil fuels. The issue of energy security and environment issues made countries and researchers to look for alternate means of renewable as well as environment-friendly fuels. The most promising and economically viable alternative narrow downs to biofuels [4,5]. Various sectors are looking for alternative fuels because of the energy crisis and the fear of society for depleting earth's non-renewable resources. Among various fuel alternatives, vegetable oils and their derivatives are widely preferred [6].

Researchers from all over the world started proposing various methods to use vegetable oils in internal combustion engines. These methods include pyrolysis, micro-emulsification, direct blending with diesel, transesterification, etc. [7,8]. Haldar et al. [9] tested the Putranjiva, Jatropha and Karanja oils in a Ricardo variable compression ignition engine to investigate and compare the results of performance and emission properties. It was found that the non-edible oil of Jatropha gives the best performance and emissions results at all the load conditions compared with other vegetable oils. Saravanan et al. [10] have investigated the feasibility study of crude rice bran oil as a diesel substitute in a compression ignition engine without any modifications. They reported that thermal efficiency of the engine with rice bran oil is slightly lesser than diesel, but resulted in better emission characteristics.

Naga Prasad et al. [11] investigated the compression ignition engine with neat castor oil and its blends with diesel and found that the performance characteristics are reduced to those of diesel. But they also found that the emission characteristics are increased at the rated load

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https://doi.org/10.1016/j.fuel.2019.02.106
Received 28 March 2018; Received in revised form 11 January 2019; Accepted 19 February 2019

ISSN NO: 2279-543X

LOW-COST WIRELESS TELEMETRY SYSTEM FOR DEEP BRAIN STIMULATION

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Abstract: *In this paper, a constant current stimulator is developed for Deep Brain Stimulation studies based on Brain-Computer Interface System. The system can deliver the precise amount of current pulse, and the feedback path ensures the system is reliable. The system has a size of 25mm* 35mm and weight of 8.5 grams including the battery which is a perfect suite in animal models. The main feature of this system is a low powered processor, long life of two months, low cost, precision and the compact size. In vitro results proved that the system is ready to use in animal models.*
Keywords: *Deep Brain Stimulation, Current, Pulses, Intracranial Self Stimulation*

1. INTRODUCTION

Deep Brain Stimulation (DBS) is becoming a promising solution for treating Neuropsychological disorders. In many countries, this treatment is an approved and useful therapy for many patients. As the technology acquires a prominent space in our daily life, there is a new perspective to look into this treatment. Brain-Computer Interface is such a type of approach that makes to explore these fields. One of the applications of this technology is in the area of DBS. Studying the animal model using DBS is the most important factor since it is intended to apply in human models [1]

DBS has a history of more than 50 years. So it took a long way to emerge as present [2]. An old way of DBS was using cable connections between the equipment and the subject. There were a lot of issues using cables connections about cable entanglement and breaking of the cables [3]. As a solution to all these, different types of wireless stimulators were introduced. There were many drawbacks related to size, precision, software and lifetime for these wireless stimulators. Though stimulators are available commercially, they are all expensive in nature and so customers are not interested to have this product [4]. In the view of all these factors, we are developing and modelling a new stimulator system that overcomes the limitation of size, weight, precision and lifetime.

2. METHOD

The new wireless stimulator consists of a base station, system and backpack. Here the system can be either a computer or a mobile. This system will be serving as the main controller to the base station and the backpack.

Thin Solid Films 610 (2016) 48–57

Contents lists available at ScienceDirect

Thin Solid Films

journal homepage: www.elsevier.com/locate/tsf

Tuning characteristics of Co_3O_4 nanofiber mats developed for electrochemical sensing of glucose and H_2O_2

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ARTICLE INFO

Article history:
Received 4 August 2015
Received in revised form 1 May 2016
Accepted 3 May 2016
Available online 5 May 2016

Keywords:
Nanoceramic
Sol–gel
Glucose
Sensor

ABSTRACT

Nano-crystalline Co_3O_4 nanofibrous mats were fabricated by calcining the precursor nanofibers obtained by electrospinning of a sol comprising of a unique polymeric binder poly(2-ethyl-2-oxazoline) and cobalt acetate tetrahydrate in water. The influence of the calcination temperature used for the synthesis of the oxide nanofibers from the xerogel fibers on various physico-chemical properties of the former was studied. The Co_3O_4 nanofibers obtained at 400 °C had the highest electrochemical sensitivity towards glucose and H_2O_2. Further, the results prove that Co_3O_4 nanofibers can be used for the detection of glucose and H_2O_2 concurrently as the response times taken by these moieties are different. Therefore, one can differentiate the concentration of glucose and H_2O_2 by analyzing the signals obtained after the respective response time and this multiple sensitivity of Co_3O_4 can be applied in the field of biosensors.

1. Introduction

In pursuit of fabrication of high aspect ratio oxide nanofibers, sol–gel electrospinning has gained remarkable attention. Combining electrospinning and sol–gel processing is the best strategy for the fabrication of oxide nanofibers for specific advanced applications. In a sol–gel assisted electrospinning process for the fabrication of oxide fibers, xerogel nanofibers from a metal salt and a polymer are prepared through electrospinning, which are calcined later above the degradation temperature of both the polymer and metal salt. The composite nanofibers are prepared from a sol of adequate viscosity containing the metal salt and a polymer in a suitable solvent. The interaction of metal salt with the polymer and the nature of degradation of polymer can influence the properties of the oxide fibers [1].

1-D nanomaterials are particularly important over nanoparticles in the field of sensing, since the continuous electron transport of the former can significantly improve their sensitivity, limit of detection, response, resolution etc. There are several oxide nanomaterials with different morphologies, which are prepared by different techniques and used for the fabrication of solid state sensors and electrochemical sensors. In both solid state sensors and electrochemical sensors, the role of nanomaterials is to receive the target analytes and convert their molecular information to a measurable signal [2]. Nanosized metal oxides, such as CuO [3], ZnO [4], TiO_2 [5], SnO_2 [6] and NiO [7] have gained importance in the electrochemical determination of various analytes because of their electrocatalytic activity. The high aspect ratios, morphology and structure dictate sensitivity of oxide materials [8].

Among oxide nanomaterials, cobalt oxide with different size and morphology has been used in the non-enzymatic electrochemical detection of glucose. Cobalt oxide has a spinel structure with Co^{2+} ions in the tetrahedral voids and Co^{3+} in the octahedral ones. The presence of these two ions imparts multifunctionality to Co_3O_4. Hence, it has been used in sensors [9,10], electrochromic devices [11,12], solar energy absorbents [13], supercapacitors [14,15], lithium-ion batteries [16,17], H_2 generation [18], heterogeneous catalysts [19–22], magnetic materials [23,24] and oxygen evolution and reduction [25]. Non-enzymatic sensing of oxides is promising than the enzyme-based sensors, since the cost of developing enzymes is very high and these enzymes degrade as the detection progresses make them suitable only for a single use. Also, the presence of other substances, in addition to the analyte can interfere with the response in enzymatic sensors. Oxide materials are comparatively cheaper and reusable and their electrochemical sensing is interesting because of their low detection limit, high selectivity and high sensitivity [26]. The sensing behavior of the oxides is enhanced at nanoscale dimensions, and the sensitivity is affected by the grain size, vacancies and surface area of the intended nanomaterial.

Glucose is a widely tested analyte in blood and urine. Frequent monitoring of glucose is essential in controlling diabetes mellitus and it has become a regular practice by millions of people suffering from this disorder [27]. A cheap and sensitive detection of glucose is thriving and it is crucial for the humankind. Immobilizing enzymes, such as glucose oxidase, on various substrates is an existing technique for the determination of glucose level in body fluids. This is a destructive

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http://dx.doi.org/10.1016/j.tsf.2016.05.005
0040-6090/

Indian Journal of Science and Technology, Vol 9(39), DOI: 10.17485/ijst/2016/v9i39/100777, October 2016
ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645

Semi-Supervised Distributional Vector Generation Techniques for Text Classification

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Abstract

Text class has loved its privilege as a core studies area in text mining. Supervised, unsupervised are the 2 famous paradigms within the technique of type. Relatively novel method of classification is semi-supervised mastering which is midway among the supervised and unsupervised getting to know. With smaller schooling statistics units and taking the large without problems to be had unlabeled data, the procedure of studying in class is refined. There are versions in semi-supervised, transductive gaining knowledge of wherein the trained and untrained facts are given in advance the classifier is built, the goal is to expect the magnificence label of untrained data. The opposite version is inductive learning in which the labeled and unlabeled statistics is utilized in model constructing; goal of the version is to predict the unseen information magnificence label. The paper aims to using transductive getting to know to classifying the textual statistics with the aid of considering the phrases appearing in special parts of the record. The words performing inside the introductory and conclusion a part of the files may additionally play important function within the procedure of type, than the ones seemed in other parts. The approach employed could provide one of a kind weights to words primarily based on their presence in one-of-a-kind role of the document. Taking into consideration the above within the procedure of mapping the textual facts into numerical patterns editions of distributed vector generations are acquired. Taking into account large differences in the duration of the documents, distinct normalization techniques are employed which gave eights one-of-a-kind vectors. Non-parametric, most effective to put into effect ok-nearest neighbour algorithm is hired for free-go with the flow textual classification. The outcomes received conclude that semi-supervised textual class can be carried out without loss in category accuracy where restrained skilled records is to be had, as the accuracies of the gaining knowledge of model in supervised and emi-supervised coincide with each other.

Keywords: Distributional Vectors, KNN, Semi-Supervised, Text Classification, Transductive Learning

1. Introduction

Text type has loved as a core studies region in domain of text mining particularly after the generation of electronic textual information mills. Greater ever the fee of textual records technology has multiplied due to the usage of intra, internet utilization in enormous areas. The sole cause to shop the data is for evidence checking alone, so no effort is employed to save the information in categorized repository. Keeping in view of the future wishes of choice making, if the statistics is stored in categorized repositories, then navigation and use of it decision making becomes simpler. The most popular models for records classification commonly are supervised and unsupervised as given in[1]. Supervised type is a predictive version where the task is to educate a version based totally on training records, the education records is classified. The version constructed is used to assign a pre-defined elegance label to new facts as in[13]. Unsupervised mastering do not have education records, it corporations the given information into clusters primarily based at the similarity as in[6]. The statistics within the similar cluster are handled to belong to same magnificence. Semi-supervised is relative new process model which takes smaller education statistics units mixed with massive to be had unlabeled facts to categorise the records. Normally bag-of-words (bow)

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