



DESIGN OF AUTOMATION CONTROL THERMAL SYSTEM  
INTEGRATED WITH PARABOLIC TROUGH COLLECTOR  
BASED SOLAR PLANT

by

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*This paper presents enhanced design for automation control of processes involved in a solar system which utilizes programmable logic controller to automate tracking system for obtaining maximum solar radiation. Three areas are involved in this proposed multi area system where 1<sup>st</sup> and 2<sup>nd</sup> area considers solar power plant with thermal system based parabolic trough collector with fixed solar isolation and random isolation of solar energy whereas third area comprises of solar thermal system with dish Stirling realistic unit. Energy efficiency can be increased by using solar concentrator along with Stirling engine. Optimization of gain of the controller is by utilizing crow search novel algorithm. Crow search algorithm is an optimization technique, which provides better performance at complex time varying noisy condition and time in-varying noisy condition. The proposed controller is evaluated by obtaining the optimized parameters of the system whose comparison is done by operating proposed controller with and without renewable sources of energy thereby revealing better performance for both conditions. Testing is done in different areas with fixed solar isolation and random isolation of solar energy involved in solar thermal power plant based on parabolic trough collector. Gain and parameters of the controller of the solar power plant are optimized by utilizing automation for operation of solar concentrator with parabolic trough collector. Data acquisition and monitoring is done by human machine interface in order to report safe operation. The simulation results of integrated solar thermal system involving dish Stirling with parabolic trough collector, shows that dynamic response of the proposed controller operating with renewable solar energy is better than that of non-renewable energy source.*

**Key words:** automation control, power system, thermal power, human machine interface, solar energy

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**Comparative Study of Neural Network and Tree-Based Models in Solar Irradiance Prediction**

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**Abstract**

Solar Photovoltaic Systems have become the most promising technology for clean energy generation in recent years. Solar irradiation is one of the critical factors that affect Photovoltaic output. Since the Photovoltaic output varies significantly during the day, accurate solar irradiation forecasting is essential for predicting Photovoltaic output. Many machine-learning models have been used to forecast solar irradiation in the last few decades. This paper evaluates the performance of two basic machine-learning models: Artificial Neural Networks and Tree-based methods for solar irradiance prediction. Two neural networks such as Multilayer Perceptron, Radial Basis Function Neural Network, and three tree-based models such as Classification and Regression Tree, Alternating Model Tree, and Random Forest are applied to predict the solar irradiance using the NASA Solar Irradiance dataset. The performance of those methods is assessed using various metrics like the Correlation Coefficient, Mean Absolute Error, and Root Mean Squared Error. The experimental results show that the tree-based ensemble methods perform significantly better than neural network models for solar irradiance prediction.



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Research Article

Investigation into Mechanical Properties and Sliding Wear Behavior of Friction Stir Processed Surface Composite Material

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One of the different and pioneering solid-state techniques, friction stir processing (FSP), is employed for the production of surface composites. In this research, the matrix selected was copper-nickel (CuNi) with hard boron carbide particle as reinforcement. The objective of the current research work is to produce reinforced 90/10 copper-nickel surface composites reinforced with B<sub>4</sub>C fabricated via FSP. The influence of tool rotational speed on macrostructure, microstructure, grain size analysis, microhardness, and wear studies of friction stir processed (FSPed) CuNi/B<sub>4</sub>C surface composites was assessed. For high rotational speed (1400 rpm) of stir tool, the modified surface area found is a maximum of 44.4 mm<sup>2</sup> with uniform dispersion of hard particle reinforcement. The presence of hard particle in the surface area is revealed through the electron imaging and the spectroscopic results. Spectra mapping shows the uniform distribution of hard particle over the FSPed area, and the evidence is obtained with XRD analysis. From the experimentation, it is interesting to report that the reinforcements have decreased the surface hardness for an increased rotational speed of stir tool. The hardness recorded for minimum rotational speed is 223 HV which has gradually decreased to 178 HV for 1300 rpm. It has directly influenced the wear rate of modified FSPed, as hardness is directly proportional to wear behavior. The worn surface and fractured morphology of the CuNi/B<sub>4</sub>C surface composites were also studied using Field Emission Scanning Electron Microscope (FESEM).

1. Introduction

The evolution of modern material science and techniques of material synthesis has developed the production of composite materials with enhanced performance for use in aerospace and other demanding industrial applications. Composite materials are one of the essential and versatile engineering materials. The development in the field of material science and technology has made the production of advanced composite materials possible. Composite

materials possess a unique combination of properties such as high strength, high toughness, lightweight, low cost, good damping capacity, wear resistance, corrosion resistance, hardness, conductivity, creep strength, fatigue strength, negative thermal expansion coefficient, and unusual combinations of electrical and magnetic properties depending on their alloying elements and processing techniques.

Cupronickel (CuNi) alloy is extensively used for high temperature and corrosion resistance applications. The



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Research Article

Qualitative Property of Third-Order Nonlinear Neutral Distributed-Delay Generalized Difference Equations

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This paper investigates the qualitative property of third-order nonlinear neutral distributed-delay generalized difference equations. By utilizing Philos-type technique and Riccati transformation, some oscillation criteria are presented to ensure that every solution of this equation oscillates or converges to zero. To illustrate the significance of our main result, we provide a suitable example.

1. Introduction

In several areas, such as electrical circuit analysis, finance insurance, dynamic systems, computing, and physical field, third-order difference equations appeared to scrutinize discrete models, naturally occurring in discrete models pertaining physical, biological, and chemical phenomena (see, for example, [1-8]). In many engineering problems, analyzing the existence of oscillatory solutions performs an essential role. Notably, numerous monographs concern with issues of the existence and multiplicity of solutions using

different methods, such as critical point theory, topological degree theory, fixed-point index theory, and Lie theory. In recent years, there has been a continual interest in getting sufficient conditions for oscillatory behavior of different classes of third-order difference equations with or without deviating arguments (see [8-23] and the references cited therein).

The third-order nonlinear neutral distributed-delay generalized differential equation is of the form

Delta\_ell(a\_1(k)[Delta\_ell(a\_2(k)[Delta\_ell z(k)]^{gamma\_1})]^{gamma\_2}) + sum\_{s=k}^d q(k,s)f(x(k+s-ell)) = 0, (1)

where z(k) = x(k) + sum\_{s=k\_0}^k p(k,s)x(k+s-tau) and Delta\_ell is the forward generalized difference operator well defined by Delta\_ell x(k) = x(k+ell) - x(k), N\_{k\_0}(k\_0) = {k\_0, k\_0 + ell, k\_0 + 2ell, ...}, k\_0 in [0, infinity), ell in (0, infinity), and a, b, c, d in N(k\_0), which subject to the following conditions:

- c\_1: the sequence {a\_i(k)} is positive real and sum\_{k=k\_0}^infinity (1/a\_i)^{gamma\_i}(k) = infinity, for i = 1, 2.

- c\_2: {p(k,s)} and {q(k,s)} are nonnegative real sequences along with 0 <= p(k) = sum\_{s=k\_0}^k p(k,s) <= p < 1.
- c\_3: gamma\_1 and gamma\_2 are a quotient of odd positive integers with gamma\_1 = gamma\_1/gamma\_2.
- c\_4: the function f: R -> R is continuous with (f(x)/x^L) >= L > 0, where x != 0 and L is a constant.
- c\_5: m\_j(k) = [(k - k\_0 - j - ell)/ell], k\_bar\_j = k\_0 + j, and j = k - k\_0 - [(k - k\_0)/ell]ell.



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## **Oscillation and Non-Oscillation of Fourth Order Neutral Distributed Delay Generalized Difference Equation**

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### **Abstract**

The oscillatory and non-oscillatory properties of fourth order neutral generalized difference equations with distributed delay are discussed in this paper. Sufficient conditions for the oscillation and asymptotic behavior of non-oscillation of all solutions of the given equation are obtained. To substantiate our findings, adequate examples are presented.

**Keywords:** Generalized difference operator, Oscillation, Non-oscillation, Delay, Neutral, Fourth order.

**AMS Subject Classification [2000]:** 39A10, 39A11.

### **1. INTRODUCTION**

In the recent past, the study of oscillation and non oscillation of generalized difference equations gains momentum and is an active area of research. The analysis of asymptotic behaviour of non-oscillatory solutions has already been studied by many researchers. A few authors have studied the behaviour of such solutions for delay difference equations. One can refer [1]-[3],[9]-[11] for the required literature on this topic.

As in differential equation with symmetries, Different schemes can be constructed which preserves the symmetries. In Lie theory, difference equations play a significant role. In Lie theory, discretization of the continuum equation which preserves the symmetries leads to a class of exact solutions. For an in-depth understanding of this areas one can refer [6]-[8].



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## Stability and Boundedness of Solutions of Fibonacci-Nabla Partial Difference Equations

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### Abstract

This research aims to obtain the numerical and closed form solutions and discuss the stability and boundedness behavior of the solutions of certain type of generalized difference equation and generalized Fibonacci nabla partial difference equation with several variables and shift values. Required examples with illustrations have been given for validating our main findings.

**Key words:** Generalized Difference Equations, Exterior functions, Stability and Boundedness, Fibonacci Nabla Operator.

**AMS classification:** 39A13.

### 1. INTRODUCTION

Recently, there has been a great interest in studying the qualitative properties of generalized difference equations with several variables. For the systematic study of generalized difference equations generated by the delta operator with shift values, one can refer to the papers [2]-[11] and the references cited therein.



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## Stability of a Quadratic Functional Equation

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### Abstract

This paper deals with the Ulam-Hyers stability of a quadratic functional equation

$$q\left(x - \frac{y+z}{2}\right) = \frac{1}{2}(q(x-z) + q(x-y)) - \frac{1}{4}q(z-y)$$

using direct and fixed point methods in fuzzy normed space.

**Keywords and phrase:** : Fuzzy normed space, Quadratic functional equation,  
Generalized Hyers-Ulam-Rassias stability, Fixed point method

**2010 Mathematics Subject Classification:** 39B52, 39B82, 26E50, 46S50

### 1. INTRODUCTION

One of the most interesting questions in the theory of functional analysis concerning the Ulam stability problem of functional equations is as follows: when is it true that a mapping satisfying a functional equation approximately must be close to an exact solution of the given functional equation?



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## Initial Coefficient Estimates for Certain Subclasses of m-fold Symmetric bi-univalent Functions

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### Abstract

This paper provides the two new subclasses of the function class  $S_{\Sigma_m}(\alpha, \tau, \lambda)$  and  $S_{\Sigma_m}(\beta, \tau, \lambda)$  of analytic and bi-univalent functions defined in the open unit disk  $\mathbb{U} = \{z : |z| < 1\}$ . Besides, Find estimates on the coefficients  $|a_{m+1}|$  and  $|a_{2m+1}|$  for functions in these new subclasses. Many interesting new and already existing corollaries are also presented.

**Key words and phrases:** m-Fold symmetry, bi-univalent functions, coefficient estimates

**2010 Mathematics Subject Classification:** 30C45, 30C50

### 1. INTRODUCTION, DEFINITIONS AND PRELIMINARIES

Let  $\mathcal{A}$  denote the class of all functions of the form

$$f(z) = z + \sum_{n=2}^{\infty} a_n z^n. \quad (1.1)$$

which are univalent in  $\mathbb{U}$  and normalized by the conditions  $f(0) = f'(0) - 1 = 0$ . Let  $\mathcal{S}$  subclass class of function of  $f \in \mathcal{A}$  consisting of the form (1.1) which are also univalent in  $\mathbb{U}$ .





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**Ferroelectrics**




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## Dielectric relaxation and optical properties in ferroelectric bis(methylammonium) tetrachloro zincate single crystal



S. Anitha, R. Priya, P. S. Latha Mageshwari & S. Jerome Das



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## Structure, hirshfeld surface studies, optical and mechanical analysis on a third-order nonlinear optical crystal 2-amino-6-methylpyridin-1-ium 2-chloro-4-nitrobenzoate (2A6M2C4N)

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### ABSTRACT

Organic third order nonlinear optical material, 2-Amino-6-methylpyridin-1-ium 2-chloro-4-nitrobenzoate (2A6M2C4N) was effectively synthesized and single crystals were developed by slow cooling solution growth method. The crystallographic structure of the grown crystal has been confirmed through single crystal X-ray diffraction analysis and it uncovers that the title material belongs to Triclinic crystal system with centrosymmetric space group of P-1. The crystalline phase formation was ascertained from powder X-ray diffraction measurements. The functional groups present in the compound were confirmed by Fourier transform infrared analysis. Optical analysis explicit that the grown crystal possess good transmittance in the wave length region of 200–800 nm. Photoluminescence spectroscopy analysed by exciting the material at 320 nm supports that 2A6M2C4N crystal suits the requirements of optoelectronic devices. The thermal behaviour of 2A6M2C4N exploited by TG-DTA measurements show that it is stable up to 160.04 °C. Third order nonlinear optical properties such as nonlinear refractive index and third order nonlinear optical susceptibility were calculated by employing the  $\pi$ -scan technique. The HOMO-LUMO, molecular electrostatic potential (MESP) and contour map of the molecule was examined at B3LYP/6-311++G (d, p) level by using DFT calculations. The existence of the intermolecular interactions in the molecule were confirmed by Hirshfeld surface studies.

### 1. Introduction

In modern research, organic molecular compounds are exceptionally appealing for several applications in the bandwagon of optoelectronics, optical signal processing, optical switching, and photonics [1–4]. These organic molecules have procured interest than the inorganic materials, as they have high laser damage threshold, large nonlinear optical (NLO) coefficient, fascinating structural design, fast optical response etc [5–7]. This leads to look forward for new organic structure that has one of a kind of physicochemical properties. Moreover, synthesis of new donor- $\pi$ -acceptor type organic molecules with enhanced NLO properties has a significant focus of research due to its broad applications [8,9]. In common, organic materials exhibits high order of electron delocalization and remarkable intermolecular charge transfer with large NLO effects [10,11]. It is ought to be said here that organic cations and anions

produces hydrogen bonded systems which are pivotal for proton transfer [12,13]. Materials that possess third order NLO properties are broad intrigued owing to their endless and assorted range of applications in fabrication of optical limiting devices, optical switches, optical disk data storage, colour displays etc [14–17]. Molecular level polarizability of organic materials causes the macroscopic effect and leads to third order NLO susceptibility. In later investigate, pyridine based organic crystals with enhanced  $\pi$ -conjugated systems shows prevalent second and third order NLO responses. For occurrence, pyridine-based compounds such as 4-Aminopyridinium 2-chloro-4-nitrobenzoate monohydrate [18], 2-Aminopyridinium 2-chloro 4-nitrobenzoate [19], 2-Amino 4-methylpyridinium 3-chlorobenzoate [20], 2-Amino-6-methylpyridinium succinate [11], bis (2-amino-6-methyl pyridinium barbiturate) tetrahydrate [21], 2-amino 4-methylpyridinium tartrate monohydrate [22] are extensively studied and their physicochemical, nonlinear optical

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## Exploration on reduced graphene oxide/strontium pyro niobate electrode material for electrochemical energy storage applications

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### Abstract

Most recently, graphene-related composite-modified electrode surfaces have been widely employed to improve surface interactions and electron transfer kinetics. Hydrothermally prepared strontium pyro niobate (SPN) and reduced graphene oxide/strontium pyro niobate (RGOSPN) nanostructures reveal excellent morphology. X-ray diffraction analysis of SPN and RGOSPN agree with standard data. Thermogravimetry–differential scanning calorimetry analyses show that RGOSPN has higher thermal stability than SPN. In addition, from the polarization–electric field ( $P$ – $E$ ) loop measurements, the estimated value of remnant polarization ( $P_r$ ) and coercive electric field ( $E_c$ ) of SPN are  $0.039 \mu\text{C cm}^{-2}$  and  $-2.90 \text{ kV cm}^{-1}$  and that of RGOSPN nanocomposite are  $0.0139 \mu\text{C cm}^{-2}$  and  $-2.04 \text{ kV cm}^{-1}$ . Cyclic voltammetry measurements show that RGOSPN nanocomposite manifests the possibility of electrochemical reversibility beyond long cycles without change in performance. The redox cycle reveal that RGOSPN can be used as part of a composite electrode for hybrid capacitors dynamic conditions. Moreover, the specific capacitance of SPN and RGOSPN was calculated using galvanostatic charge–discharge (GCD) technique. The observed energy density of  $9.1 \text{ W h kg}^{-1}$  in RGOSPN is higher when compared with previous reported values.

**Keywords** Hummer's method · Hydrothermal method · Nanocomposites · Columbite · Electrochemical studies · Impedance spectroscopy

### 1 Introduction

Development of novel technology for sustainable energy production and affordable health care system are the significant challenges among researchers in the recent days. Electrochemistry plays a substantial role in several chemical and biological sensors as well as energy storage devices. This utilizes energy as electricity to gather or inoculate electrons through electrodes in clean form. Recently, graphene-supported metal, metal oxides and polymer has gathered

much interest in developing bifunctional catalyst for energy conversion system [1].

Columbite compounds are found with a combination of fascinating physical properties such as piezoelectric, magnetic, catalytic, photovoltaic, ferroelectric and dielectric [2, 3]. These properties make them suitable for a wide range of applications. Columbites have also put into the energy conversion process as active electrode materials to enhance the composite behavior, owing to its high electronic and ionic conductivity [4–7]. Columbite ferroelectric materials are significant materials identified by the presence of a change in spontaneous polarisation in accordance with applied external electric field. Ferroelectrics usually include titanates, zirconates and niobates which are structure-dependent type [8].

Graphene, an allotrope of carbon plays a significant role in all aspects such as energy storage devices, energy generation devices, catalysts, sensor fabrication, and cost-effective water purification. Advanced graphene-based materials always bring new perspectives and prospects to the electrochemical systems. Graphene has been incorporated along with columbite to improve electrochemical performance of the composites. Strontium pyro niobate with

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## Green Synthesis Of CdS Quantum Dot Using (Citrus Limon (L.) Osbeck) Leaves Extract As Stabilizing Agent And Investigate Its Emission Properties

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BET

### ABSTRACT

In the current research, the CdS has been synthesized through greens method, in which lemon leaves extract acted as stabilizing agent and the characterization techniques like PXRD, SEM, EDX, FTIR, UV, DLS, CIE and BET are used to investigate CdS. PXRD confirmed the crystalline size as 3 nm with stable cubic structure of CdS. Spike like morphology was identified by SEM. The influence of lemon leaves extract on the structural and optical properties were discussed in the FTIR and UV spectra. The bandgap energy of synthesized CdS was found to be 3.07 eV. The secondary particle distribution of CdS was found to be 204 nm which confirms the quantum size effect. The CIE 1931 chromaticity diagram was analyzed to explore the dominance emission of CdS quantum dot. The pore size, pore volume and surface area of the sample were measured by BET. BJH, N<sub>2</sub> Adsorption-Desorption Isotherms, which have revealed the synthesized compound were suitable for QDSSC and Photovoltaic application.

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### 1. Introduction

The study of fundamental role of quantum size effect mainly depends on unique properties of nanomaterials [1–3]. When compare to other semiconductors QDs like CdSe, CdTe, ZnSe, CdS and ZnS attracts the researchers, due to its optical bandgap which is useful in different applications ranging from optoelectronic devices to biomolecular applications [4–6]. CdS is a most promising material with band gap of 2.42 eV (~516 nm) and can be tuned to 4.5 eV [7,8]. As the aspect ratio is inversely proportional to the size, there must be controlled synthesis for deriving small sized particle. The changes in the size and size distribution of the QDs are the attributes to its optical properties, which could be easily obtained by green method rather than physical and chemical methods. More-

over, green synthesis is very ecofriendly, reduces fast and cost effective [9–12]. Very few reports ,relatively on preparation of CdS NPs using the green synthesis method, in which orange peel, tea decoction are used as the capping agents [13,14].

As per our research analysis history, no attempt has been made to prepare CdS NPs with lemon leaves extract yet. A Novel strategy has been used to prepare CdS using lemon leaves extract as reducing and capping agents where cadmium acetate and sodium sulphide are used as precursors.

### 2. Experimental

CdS nanoparticles are synthesized from cadmium acetate and sodium sulfide. We have freshly prepared 0.2 M of sodium sulphide solution, then slowly added 10 ml of lemon leaves extract to this solution and stirred it vigorously and light brown color solution was obtained. Then 0.2 M of cadmium acetate solution was added to this mixture, at this stage yellow precipitate is formed

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# R.M.D. ENGINEERING COLLEGE

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## DEPARTMENT OF SCIENCE AND HUMANITIES

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### ULTRASONIC VELOCITY STUDIES OF BENZOIC ACID AND SUBSTITUTED BENZOIC ACIDS IN AQUEOUS MIXED SOLVENT SYSTEMS

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#### ABSTRACT

The ultrasonic velocity of benzoic acid and substituted benzoic acids such as para chloro benzoic acid, para nitro benzoic acid and meta nitro benzoic acid in ethanol-water binary solvent mixtures of several compositions were evaluated. It finds immense applications in the field of several technological and industrial processes such as petrochemical, pharmaceutical and in the manufacture of dyes. The results of ultrasonic velocity determination are remarkably important in the determination of liquid mixtures that are made up of polar and non-polar compounds. The structural modifications of ethanol get into a 3-D network of linkages made up of hydrogen bonds in liquid mixtures. In the present study, it is inferred that a weak molecular association exists between ethanol and the substituted benzoic acids through weak dipole-dipole interactions. The probability of the development of donor-acceptor complexes has also been examined and subsequently discussed. In addition, the effect of substituents like the nitro and the chloro group at the para and meta positions has also been interpreted.

**Keywords:** Benzoic Acid, Ultrasonic Velocity, Solute-solvent Interactions

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#### INTRODUCTION

The results of ultrasonic velocity studies are extremely useful in identifying the acoustical and thermodynamic parameters that are significantly perceptible to molecular interaction studies.<sup>1,2</sup> The structure of molecular liquids can be speculated from the results of thermodynamic and transport properties. The results also throw light on the presence of intermolecular interactions that exist in the liquid mixtures. Alcohols are highly self-associated liquids. Both inter and intramolecular hydrogen bonding is found in alcohols.

The most important property of alcohols is their application as solvents and they are of a major utility in biology, chemistry and pharmaceutical studies. Likewise substituted benzoic acids like p-chloro benzoic acid, m-nitrobenzoic acid and p-nitrobenzoic acid are mainly used in a variety of industrial applications. The 3-D network of hydrogen bonding in alcohols makes it an interesting aspect to highlight the diverse types of molecular interactions and associations in organic ternary mixtures having alcohol, a self-associated liquid in the mixtures. It can associate with any other compound which has a group that is susceptible to polar associations.

The variation of ultrasonic velocity unravels the changes associated with the structure of the weakly associating and strongly associating components in the binary liquid mixtures.<sup>3-5</sup> The molecules of benzoic acid are connected by hydrogen bonds and exist as a dimer with D<sub>2h</sub> symmetry. There are several chances for ethanol to interlink and form a complex which is hydrogen-bonded with benzoic acid and the substituted benzoic acids. The structure may be due to the nature of ethanol which can act both accept hydrogen bonds strongly as well as act as a weak hydrogen bond donor.

Thus, mixing the different substituted benzoic acids in aqueous ethanol mixtures gives interesting results due to the presence of specific interactions that may arise due to the charge-transfer forces, dipole-dipole interactions, donor-acceptor properties and hydrogen bonding of the mixtures.





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Article

## Image Manipulation Detection Through Laterally Linked Pixels and Kernel Algorithms

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**Abstract:** In this paper, copy-move forgery in image is detected for single image with multiple manipulations such as blurring, noise addition, gray scale conversion, brightness modifications, rotation, Hu adjustment, color adjustment, contrast changes and JPEG Compression. However, traditional algorithms detect only copy-move attacks in image and never for different manipulation in single image. The proposed LLP (Laterally linked pixel) algorithm has two dimensional arrays and single layer is obtained through unit linking pulsed neural network for detection of copied region and kernel tricks is applied for detection of multiple manipulations in single forged image. LLP algorithm consists of two channels such as feeding component (F-Channel) and linking component (L channel) for linking pixels. LLP algorithm linking pixels detects image with multiple manipulation and copy-move forgery due to one-to-one correspondence between pixel and neuron, where each pixel's intensity is taken as input for F channel of neuron and connected for forgery identification. Furthermore, neuron is connected with neighboring field of neuron by L channel for detecting forged images with multiple manipulations in the image along with copy-move, through kernel trick classifier (KTC). From experimental results, proposed LLP algorithm performs better than traditional algorithms for multiple manipulated copy and paste images. The accuracy obtained through LLP algorithm is about 90% and further forgery detection is improved based on optimized kernel selections in classification algorithm.

**Keywords:** Machine learning; copy move forgery; support vectors; kernel; feature extraction

### 1 Introduction

Recently, free image editing tools available in internet leads to duplication of image and detecting duplication in image is a major problem for many researchers. In this internet world, day-by-day digital photo plays a vital role in various e-commerce applications such as sales and marketing. Furthermore, sharing of digital image in social media is increasing exponentially. However, identifying original image needs efficient software tools based on type of duplication of image such as copy-move, splicing, digital watermarking, digital signature, and image compression and re sampling duplicated images. Among the above duplication of image, copy-move duplication is more in social media, due to availability of many



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## An Improved Single Stage Phase Shifted Control Based AC–DC PFC Converter for Wireless Applications

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### Abstract

Recently, many researchers has more attention in a single stage AC to DC converter features and DC to DC regulator are extensively used into low power applications. When compared with the two stage conventional method over the Single stage converter has a simple design and utilize only less components. Therefore, this task has been used in this paper as a proposed work of AC–DC single stage converters combine a converter front end with DC–DC back end converter. This proposed work has been improved single stage power factor correction (PFC) converter based on phase-shifted controller for wireless Power applications. The proposed technique employed to develop the improved converter for task of an extensive series of voltage outputs with rippleless outcomes in low frequency, that shows the high essential in battery application and the PFC duty ratio restriction is eradicated. Similarly, DC–DC stage operation are designed in a related way of conventional full bridge phase shifted converter. Accordingly, the proposed technique of improved converter of this paper will achieves better efficiency compared with other conventional techniques and it has been prove more efficient for many Industrial applications, it has been discussed in result section clearly. The experimental results of proposed improved converter proves that it is potential to extend high power single stage converter with good power factor, conversion characteristics and efficiency.

**Keywords** Single stage converter · Full bridge AC–DC converter · Wireless communication · PFC · DC–DC converter

### 1 Introduction

Generally, storage devices like lead acid battery and Li-ion battery are used extensively in various applications [1]. These batteries were used in uninterrupted power supply, and improving power density and efficiency [2]. A conventional topology for charging batteries designed with isolated two stage converter. But in those converters, more switches are essential to attain the isolation requirement and input of AC grid. By using

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DESIGN OF AUTOMATION CONTROL THERMAL SYSTEM  
INTEGRATED WITH PARABOLIC TROUGH COLLECTOR  
BASED SOLAR PLANT

by

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*This paper presents enhanced design for automation control of processes involved in a solar system which utilizes programmable logic controller to automate tracking system for obtaining maximum solar radiation. Three areas are involved in this proposed multi area system where 1<sup>st</sup> and 2<sup>nd</sup> area considers solar power plant with thermal system based parabolic trough collector with fixed solar isolation and random isolation of solar energy whereas third area comprises of solar thermal system with dish Stirling realistic unit. Energy efficiency can be increased by using solar concentrator along with Stirling engine. Optimization of gain of the controller is by utilizing crow search novel algorithm. Crow search algorithm is an optimization technique, which provides better performance at complex time varying noisy condition and time in-varying noisy condition. The proposed controller is evaluated by obtaining the optimized parameters of the system whose comparison is done by operating proposed controller with and without renewable sources of energy thereby revealing better performance for both conditions. Testing is done in different areas with fixed solar isolation and random isolation of solar energy involved in solar thermal power plant based on parabolic trough collector. Gain and parameters of the controller of the solar power plant are optimized by utilizing automation for operation of solar concentrator with parabolic trough collector. Data acquisition and monitoring is done by human machine interface in order to report safe operation. The simulation results of integrated solar thermal system involving dish Stirling with parabolic trough collector, shows that dynamic response of the proposed controller operating with renewable solar energy is better than that of non-renewable energy source.*

**Key words:** automation control, power system, thermal power, human machine interface, solar energy

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### Performance Improvement of Wire-Cut Electrical Discharge Machining Process Using Cryogenically Treated Super-Conductive State of Monel-K500 Alloy

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#### Abstract

In this research, the cryogenically treated superconductive Monel-K500 alloy has been machined by Wire-cut Electrical Discharge Machining (WEDM) process to improve the machining characteristics. Initially, the Monel-K500 Alloy has been cryogenically treated using -165 °C temperature of liquid nitrogen to convert the superconductive state alloy with minimum electric resistivity. The WEDM experiments have been performed using process parameters: Spark Current (SC), Pulse Width (PW), Pulse Interval (PI), Flushing Flow rate (FF), Wire Tension (WT), and Wire Feed rate (WF), and machining characteristics: Surface roughness (Ra), Material Removal Rate (MRR), and Wire Wear Ratio (WWR) by Taguchi L27 orthogonal array. The CRITIC (CRiteria Importance Through Inter-criteria Correlation) weight integrated VIKOR (ViseKriterijumska Optimizacija I Kompromiso Resenje) multi-objective optimization technique has been applied to predict the combination of process parameter settings to achieve the best machining characteristics. The predicted optimum combinations of process parameter settings have been applied to compare the WEDM performances using superconductive and normal conductive states of work materials. It was revealed from comparative studies that MRR and WWR of SCS are 14.29% and 5.48% higher and the surface roughness of SCS is 26.92% lower than NCS of Monel K500 alloy, respectively.

**Keywords** Normal-conductive state · Super-conductive state · Monel K500 alloy · WEDM · Taguchi-CRITIC-VIKOR Technique · Machining characteristics

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#### List of Symbols

$N_c$	CRITIC normalize matrix
$R_{(best)}^-$	Worst regret measure
$R_{(best)}^+$	Best regret measure
$R_i$	Regret measure
$\bar{a}_m$	Mean alternative solution
$W_i$	Weights of each attribute
$r_{ij}$	Linear correlation coefficient between $i$ th and $j$ th attributes.
$x_{i(best)}$	Best alternative solution for the $i$ th attribute
$x_{i(worst)}$	Worst alternative solution for the $i$ th attribute
$x_{ij}$	VIKOR normalization
$\bar{x}_{ij}$	VIKOR normalized factor
$\sigma_i$	Standard deviation
$r_{ij}^*$	Linear correlation coefficient between $i$ th and $j$ th attributes.
Adj. MS	Adjusted mean sequential sum of square
Adj. SS	Adjusted sequential sum of square
CI	Criterion information index



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Research Article

The Generalized Fractional Proportional Delta Operator and New Generalized Transforms in Discrete Fractional Calculus

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In this research work, the aim is to develop the fractional proportional delta operator and present the generalized discrete Laplace transform and its convolution with the newly introduced fractional proportional delta operator. Moreover, this transform is a connection between Sumudu and Laplace transforms, which yields several applications in pure and applied science. The research work also investigates the fractional proportional differences and its sum on Riemann-Liouville and Mittag-Leffler functions. As an application of this research is to find new results and properties of fractional Laplace transform, the comparison of the existing results with this research work is also done. Moreover, we used the two types of solutions, namely, closed and summation forms in Laplace transform and verified with numerical results.

1. Introduction

Nowadays, the concept of fractional calculus is a tool in mathematical modelling that mainly focuses on differentiation and integration of fractional order. This theory brings union among the concepts of positive integer order integration and differentiation [1-3]. In 1695, L'Hopital's letter has raised a relevant question, namely, "What does partial derivative of x to the power m mean if m = 1/2?" This is considered to be the initiation of some other related questions that have been raised by famous mathematicians such as Abel, Erdelyi, Fourier, Grunwald, Laplace, Letnikov, Levy, Liouville, Marchand, Reiszand, and Riemann during the 19th century. These questions are resulted by the creation of fractional calculus.

Even though, the authors in [3, 4] have considered D^alpha f in the field of fractional calculus, discrete fractional calculus received over the years. In 1956, Kuttner [5] mentioned the mth order Delta on a sequence {a\_n} as

Delta^alpha a\_n = sum\_{r=0}^infinity (-n-1+r choose m) a\_{n+r} (1)

Further, in 1974, Diaz and Osler [6] have taken the fractional order of delta on f(x) as

Delta^alpha f(x) = sum\_{k=0}^infinity (-1)^k (alpha choose k) f(x+alpha+k) (2)

In 1989, Miller and Ross [2] introduced the discrete analogue of the Riemann-Liouville fractional derivative and proved some properties of the fractional difference operator Delta^-alpha defined by

Delta^-alpha f(t) = 1/Gamma(alpha) sum\_{s=0}^{t-1} (t-s)^{(alpha-1)} f(s), sigma(s) = s+1. (3)

Additionally, in 2009, George [7] defined the Caputo discrete fractional difference as Delta^alpha f(t) = Delta^{-(m-alpha)} Delta^m f(t). Recently, Bastos et al. developed the theory on h-sum and h-difference operators in discrete fractional calculus. For



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Generalized Ulam-Hyers Stability Results of a Quadratic Functional Equation in Felbin's Type Fuzzy Normed Linear Spaces

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Abstract. This paper presents the generalized Ulam-Hyers stability of the following quadratic functional equation

$$f\left(\frac{x+y}{2} - z\right) + f\left(\frac{y+z}{2} - x\right) + f\left(\frac{z+x}{2} - y\right) = \frac{3}{4}(f(x-x) + f(x-y) + f(x-y))$$

in Felbin's type fuzzy normed linear spaces (f-NLS) using direct and fixed point methods.

1. Introduction

In 1940, S.M. Ulam [37] posed the stability problem for approximate homomorphisms. In 1941, D.H. Hyers [12] provided a partial solution to Ulam's problem for mappings between Banach spaces. In 1950, T. Aoki [2] generalized Hyers' Theorem for additive mappings. In 1978, Th.M. Rassias [28] proved a further generalization of Hyers' Theorem by introducing the concept of the unbounded Cauchy difference for the sum of powers of two  $p$ -norms. During the last three decades the stability theorem of Th.M. Rassias [28] provided a lot of influence for the development of stability theory of a large variety of functional equations. This new concept is known today with the term Hyers-Ulam-Rassias

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Key words and phrases. quadratic functional equation; generalized Ulam-Hyers stability; Felbin's fuzzy normed linear space.



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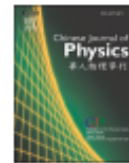


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## Prospective theoretical investigations of optical, dielectric, mechanical and third-order NLO property in potassium tri-hydrogen di-succinate single crystal

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### ARTICLE INFO

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### ABSTRACT

A propitious third-order nonlinear optical crystal potassium tri-hydrogen di-succinate (PTHS) ( $C_8H_{11}O_8K$ ) is grown by conventional slow evaporation technique maintained at 303 K. Single crystal XRD analysis (SXRD) evidences the grown crystal pertain to centrosymmetric space group  $P2_1/c$  with monoclinic crystal system and powder X-ray diffraction (PXRD) confirms the purity of the grown crystal. The existence of various functional groups was assessed by Fourier transform infrared (FTIR) spectral analysis and the optical absorption study authenticates to the transparency in the visible region. ICP-OES study substantiates the prevalence of alkali metal potassium. Interestingly, the Urbach energy of the grown crystal is explored to be minimum proving the good crystalline nature of the yielded crystal. The various optical constants were calculated in detail. The optical band gap was used to determine the position of the valence band ( $E_v$ ) and conduction band ( $E_c$ ) and the Wemple-Di-Domenico single oscillator method was used to find the different dispersive parameters. In dielectric, the various solid state parameters including electronic polarizability were calculated with different formulas and the value was proved to be higher than that of KDP. To determine the mechanical stability, Vickers microhardness test was carried out and their indentation size effect was elucidated by using different models. The crystal exhibits negative photoconductivity. By using photo acoustic study, the thermal diffusivity value is 1.25 times greater than standard KDP, signifying that the harvested crystal is remarkable material for nonlinear optical applications. In brief, the real and imaginary parts are reviewed by Z-scan technique and the susceptibility was compared with other single crystals.

### 1. Introduction

In the recent scientific era investigation on nonlinear optical (NLO) crystals and the prompt advancement in photonics, bio-photonics and optoelectronics fields have provoked scientists, fresh and beginning researchers to scrutinize on many novel

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Study on mechanical characteristics of the nano-TiC reinforced Al6061 metal matrix composites - ScienceDirect



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### Study on mechanical characteristics of the nano-TiC reinforced Al6061 metal matrix composites

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#### Abstract

The purpose of this study is to determine the wear mechanism of Al6061 metal matrix composites (MMCs) under the influence of different proportion of titanium carbide nanoparticles (nano-TiC). A sophisticated rotating tribometer was used to conduct wear testing on the prepared specimens in this study. The base material chosen for the study is Al6061, and the reinforcement has been identified as nano-TiC. Matrix alloy composites were made by stirring nano-TiC into Al6061 matrix, and applying it as a reinforcing particle. The wearing characteristic of the produced composite was investigated using an upgraded rotational tribometer. The weight percentages of the nano-TiC reinforcement were calculated as follows: 3%, 6%, 9%, and 12%. The micro-structural characterization of Al6061 MMCs demonstrates the virtually uniform mixing of reinforcements. It has been discovered that increasing the weight percent of the reinforcement upto 9% percent resulted in greater rigidity. The wearing rate was discovered to be a consequence of the sliding speeds and weight percent of the reinforcements in this investigation. With increased slide velocities, the wearing rate was noticed to be increased, significantly. The optimum hardness and wear resistance values are found at the reinforcement of 9% nano-TiC in Al6061 MMC.

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#### Keywords

Al6061, Wear characteristics, Hardness, Nano-TiC, Nano-reinforcement

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1/2



Review Article

Review and Evaluation of Power Devices and Semiconductor Materials Based on Si, SiC, and Ga-N

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There is no reservation that semiconductor equipment distorted the world despite the fact of doing the practical experiments and also in research field. Researchers will communicate the process of semiconductor statistics with nearby pupils. In this work, diverse brand of semiconductor equipment was thrashed out with elementary properties and their distinctiveness. One type of semiconductor is differentiated based on energy band gap with an added type of semiconductor equipment. Semiconductor resources are the edifice block for the electrical and electronics component. This work makes an available apt generic argument of materials with the latest discussion and its impact of temperature on different materials, and it also reveals dissimilar parameters such as modern density, porch voltage value, transmission rate, and drain resistance value. Exceptional applications were discussed for divergent semiconductor materials.

1. Introduction

In modern narration, assorted semiconductor equipment was completed with a mixture of semiconductor characteristics. A semiconductor is equipment having a conductivity array vary from one process to another process. It reveals an assortment of concert factors, and it will be discussed in the following section. It has classical band gap energy level assortment from 1 to 5 eV, while an insulator has superior crowd gap when evaluating other semiconductor equipment [1, 2]. The semiconductor equipment is accessible at room temperature more or less at 300 K and is mulled over to be smaller energy across the band gap. The equipment has the

capability to organize the indicted carriers at the furthestmost technology importance. Semiconductor equipment is very responsive to the impurity according to the precious stone lattice, and the different numbers of charge carries are at hand. It crashed on two sundry semiconductor equipment such as intrinsic and extrinsic; the resources which perform activist type of semiconductor are enabled as intrinsic, and those which result in the dopant part are enabled as extrinsic. Organic semiconductor is executed as an electrochemical scheme for various electrical and electronic devices. For example, liquid-crystal display, light-emitting diode, and sensor equip the semiconductor devices that facilitate electrical and mechanical properties [3, 4]. The greatest benefit



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Research Paper

Synthesis, spectral characterization, DFT-computational analyses on Novel 4-nitrobenzenaminium benzenesulfonate (4NBASA) crystal

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ABSTRACT

Novel 4-nitrobenzenaminium benzenesulfonate (4NBASA) was synthesized and evaluated using Fourier Transform Infrared (FTIR), <sup>1</sup>H and <sup>13</sup>C Nuclear Magnetic Resonance (NMR), Ultra-Violet Visible (UV-Vis) spectroscopy, and Single-Crystal X-ray Diffraction (SC-XRD). In addition, theoretical calculations include optimized structure analysis. The (HOMO) high occupied molecular orbital and (LUMO) lowest unoccupied molecular orbital analysis, UV-Vis. parameters with the gas base model, MEP-Molecular Electrostatic Potential, and Non-Linear Optical (NLO) properties were accomplished. All theoretical computations were completed using the DFT/B3LYP functional and the 6-311G++ (d, p) basis set in the ground state. The assignments of estimated infrared vibrational frequencies were accomplished for the first time utilizing the VEDA4 program through the optimized structure, experimental and theoretical data correspond well. In particular, the title compound 4NBASA revealed potent bactericidal activity with maximum of (16.6±1.1mm) at 2.5 µg/ml against *Staphylococcus aureus* (MTCC 3615) and minimum zone of inhibition of (10.3±0.5mm) on *Yersinia enterocolitica* (MTCC 840) and also obtained excellent antifungal activity. Further, investigations are warranted to explore their promising NLO properties and other biochemical properties.

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1. Introduction

Aniline and its derivatives are used as starting materials in pharmaceutical, electro-optical, and other industrial processes. Furthermore, the aniline substituted group leads to a charge distribution of molecules and has vibrational, electronic, and structural parameters [1]. The compound 4-nitroaniline (4NA) has attracted interest completed the last period due to its powerful biological activity, such as antibacterial and antifungal characteristics [2]. It uses silver nanoparticles fabricated microgels as the catalyst, non-biodegradable pollutant, photocatalytic degradation, make polarizable hydrogen atom and also increase the molecular hyperpolarizability [3–15]. Based on the literature, the sulfonic acid group

is an essential structural motif in both synthetic and chemistry of medicinal properties. Sulfonic acid-containing compounds are also utilized as dyes and in metal arenesulfonate complexes and many sulfonic acid-containing compounds are well-known antibacterial, antifungal, and antitubercular agents [16–21]. The Novel 4-nitrobenzenaminium benzenesulfonate (4NBASA) has been synthesized using the slow evaporation manner in methanol at room temperature. Because of the electron acceptor groups (nitro and sulphonyl), this system has a chance of hydrogen bond formation [22,23]. The higher polarity of oxygen is the reason for the delocalization of the title compound of 4NBASA.

There are so many theoretical and experimental studies revealed the importance of p-nitroaniline and substituted sulphonic acid based compounds [24–27]. The density functional theory (DFT) has been given a important role in the theoretical calculations, molecular structures, vibrational frequencies, chemical shifts, non-linear optical (NLO) effects, molecule electrostatic potential (MEP), frontier molecular orbitals (FMOs), and so on. 4NBASA

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## Mechanical properties of micro and Nano-Filler content on polypropylene composites

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### Abstract

Micro and nanofiller content were evaluated in polypropylene composites to see their effect on the mechanical properties. The matrix substantial is polypropylene; the micro-fillers are aluminium oxide (Al<sub>2</sub>O<sub>3</sub>), titanium dioxide (TiO<sub>2</sub>), and fly ash added in concentrations ranging from 0 to 30% by mass; and the nano-fillers are aluminium oxide, titanium dioxide, and clay added in concentrations ranging from 0 to 10% by mass. To conduct the test, a die with an open mould was employed. To validate the strain measurements, testings like flexural, 3-point bending, and hardness tests are made. We analyzed and estimated the flexural strength, elastic modulus, and flexibility of the composite materials. The ductility, flexural strength, and elongation at break values of samples decreased while the tensile modulus and flexural modulus risen when the proportion of micro and nano-filler content increased.

Previous

Next

### Keywords

Polypropylene, Composites, Flexural strength, Nano-fillers

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## Optical applications of sol-gel nano-composites

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### ABSTRACT

There has been a lot of research in the area of nanocomposite material for optical application. The optical qualities can benefit more technologically important forms, such as films and fibers. This paper covers the authors' results in terms of sol-gel nanocomposite for optical application over the preceding ten years. The sol-gel technique, in combinations with colloidal technologies, can be used to make nanocomposites multifunctional material focused on the integration of QDs in inorganic or hybrid organic-inorganic matrices, which have good optical property, chemicals stability, and are easy to process. Surface plasmon resonance (SPR)-based optical gas sensor show significant promise for better understanding chemical interaction at the nanoscales as well as the creation of actual device. Gas sensors with customised microstructure can be made by carefully controlling the film structure. The broad characteristics of the synthesis and characterisations of the material, as well as an findings obtained in specific situations, are detailed in both types of applications with the goal of providing an overview of the evolution of these materials.

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### 1. Introduction

As the number of uses for optical materials grows, so does the demand for new optically functional and transparent materials. In addition to optical demands such as switches and amplifiers, the material should be integrated into the existing structure such as waveguide and fibre optics. Nanocomposite materials offer a lot of promise since they can provide the necessary stability and processability for these key applications. Sol-gel nanocomposites are made with the sol-gel process for at least one of the phase. They could be obtain in two ways: "in situ" and "ex situ." A first technique has an advantages of producing the matrices as well as dispersion medium from the same batch of precursors, whereas the second method, which is based on dispersing an already synthesised dispersed phases in the matrix sol, provides for better micro structural controls.

Our study was primarily focus on the synthesis of nanomaterials for optical applications. In this work, we examine a most notable achievement in two disciplines of experiments over the last ten years: Photonic and optoelectronic nanocomposite material with semiconductors quantum dots; nanocomposites material for optical gas sensors During the first use, nanoparticles with quantum sizes ranging are placed into matrices to maintain their unique features while interfering with the host materials. The sensitive material was designed for gas sensor applications to maximise the interaction with the target gas in order to increase an variations of the optical characteristics employed for the transducing platforms. To obtain high dispersal homogeneous and treat the material to build the requisite device structures, it's vital to keep track of the matrix's structural and optical features, as well as overall nanocomposite's.

### 2. Related work

In [1], the authors have proposed the optically functional materials have been created using nanocomposite architectures. Many of semiconductor nanoparticles' fascinating optical properties, by

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## Effect of sulfated seaweed polysaccharide on flat sheet polymer (Polysulfone) membrane properties

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### ABSTRACT

Highly sustainable green seaweed derived hydrophilic sulfated polysaccharide Ulvan was (0.5 -2.0 wt. %) blended with 15wt.% polysulfone (PSf) and used as homogenous dope solution for membrane fabrication. PSf / Ulvan polymer dope solution was prepared with four different hydrocarbon solvents, N, N dimethylformamide (DMF), dimethyl sulfoxide (DMSO), N-methyl 2-pyrrolidone (NMP) and -dimethyl acetamide (DMAc). Out of these four solvents, DMSO stood out to be an incompatible one for PSf/ Ulvan composite solution. However, PSf/ Ulvan membranes were successfully fabricated with the other three solvents. Flat sheet membranes thus synthesized were characterized using pure water flux, macromolecule rejection, ATR-IR, AFM, contact angle and porosity. AFM analysis confirmed that, Ulvan influenced the surface roughness and morphology of the membranes. An appreciable change in surface roughness was noted with an increase in Ulvan concentration in the dope solution. Contact angle values were measured and it supported the behavior of Ulvan, especially the hydrophilic surface property. The effect of Ulvan as an additive (porogen) in the PSf membrane had a very high influence in the efficiency and morphological properties. Similarly, promising results were obtained with BSA rejection ranging from 78.53% to 72.56% for a time duration of 12 hours with DMAc solvent and 81.19% to 75.49% for the time duration of 12 hours with NMP as solvent. With the increase in the concentration of Ulvan from 0%to 2.5%, the flux increased from 581.8 to 991.3 LMH with DMAc as solvent. Similarly, with NMP as a solvent, the flux increased from 571.8 to 974.8 LMH.

### 1. Introduction

Membrane processes are utilized in various environmental sectors such as pollution control, cleaning technology and sustainable development. [1,2]. Several crucial parameters decide the membrane efficiency, i.e., permeability, selectivity, fouling resistance, mechanical, chemical, thermal stability, ease of operation, cost and scale up possibilities. In addition, ever increase in pollution control regulations also demand novel tailor-made structural membrane with specific properties i.e., morphology, porosity, hydrophobicity, thermal/mechanical stability, etc. Based on the specific application, membrane material can be designed with different additives, solvents & experimental conditions (temperature, humidity), chemical parameters (density, viscosity, molecular weight) and synthetic / bio-origin. The choice of suitable solvent for membrane preparation plays a very crucial role in the optimization of the developed membrane performance. Based on previous studies

[3–6], we have identified the four solvents DMF, DMAc, NMP and DMSO for our present investigation. Polysulfone is one of the most used polymers in membrane separation and pollution control strategies due to its high chemical, thermal and mechanical resistance. However, the key challenge of membrane industry “fouling” hampers the efficiency and lifetime of PSf membranes. Also, the hydrophobic nature of polysulfone affects the performance (water flux) and thereby reduces the industrial scale operations as well.

Researchers are trying for alternative pathways to change membrane surface, cross-section and performance using nano-materials, physical, chemical modifications to overcome the limitations. Several reports reveal the enhancement of fouling resistant property of membrane through coating materials (hydrophilic polymers), inorganic nanoparticles (graphene) and functional groups (hydroxyl, amine, and imine). Polysulfone membranes prepared with graphene oxide nanoparticles and graphene oxide/titanium dioxide were investigated to

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## INVESTIGATION OF ENHANCING THE PERFORMANCE AND DEPOSITION CHARACTERISTICS OF COPPER (II) METHANE SULPHONATE SALT COMPLEXED WITH D-MANNITOL BATH

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### ABSTRACT

The performance of the eco-friendly D-Mannitol electroless copper plating bath with additives has been investigated. D-Mannitol produces a lower plating rate which has been improved using exalts viz., polyethylene glycol 600, oxalic acid and malonic acid. The performance of the bath shows improvement gravimetrically and by polarization studies. The surface morphology studies are also interpreted.

**Keywords:** Eco-friendly, D-Mannitol, Additives, Copper plating, Impedance, Tafel polarization.

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### INTRODUCTION

In 1946, the origin of electroless plating was invented by Brenner and Riddell<sup>1</sup> with electroless nickel plating. In the immediate future in 1950 electroless copper was identified to develop solutions for plating plated through-hole (PTH) and printed wiring boards (PWB). In recent years electroless plating is carried out on fabrics for electromagnetic interference shielding<sup>2</sup> and the metals like silver, copper<sup>3</sup> possess the antibacterial, antiseptic and antiviral properties. The electroless copper plating baths developed earlier were subjected to spontaneous decomposition. Continual advancement has taken place in the controlling factors and continued to be confirmed in a wide range of studies.<sup>4,5</sup>

Extensive research has been carried out employing complexing agents like EDTA<sup>6</sup> (Ethylenediaminetetraacetic acid), sodium tartrate<sup>7</sup>, glycerine<sup>8</sup>, Triethanolamine<sup>9</sup>, and ammonia.<sup>10</sup> EDTA is an exceptional chelating agent which forms a metal-EDTA complex at a higher pH range and prevents Cu(OH)<sub>2</sub> precipitation.<sup>6,11</sup> Even though EDTA complexes well, it forms a stable heavy metal complex that accumulates in the environment being non-biodegradable and also enhances the nitrogen content totally in the wastewater.<sup>12,13</sup> To overcome the above drawbacks saturated polyhydric alcohols which are easily biodegradable and eco-friendly were tried as an alternative.

Saturated polyhydric alcohols<sup>14-16</sup> form a very stable complex with Cu(II) ions which in turn prevent the precipitation of Cu(OH)<sub>2</sub> at pH greater than 12. In the development of eco-friendly baths, copper methane sulphate salt has been found to be a better choice of salt for electroless copper deposition.<sup>17</sup> Additives are excellent surface-active compounds that produce a variety of effects for the metallization process.<sup>18</sup> Additives can be classified as stabilizers or accelerators. Stabilizers improve the bath stability while accelerators enhance the deposition rate.

The present investigation focuses to study the effect of D-Mannitol as a complexing agent and accelerators like polyethylene glycol 600 (PEG600), oxalic acid, and malonic acid on an electroless copper deposition by weight gain method and polarization technique. The deposit's surface morphology was well understood by XRD and SEM analysis.





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## Investigation on thermal conductivity of ceramic particles reinforced polymer composites

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### ABSTRACT

The hydroxyl group count in polymeric composites and amphiphilic investigators used as a function of  $Si_3N_4$  orientation have been investigated by the thermal conductivity of Silicon Nitride ( $Si_3N_4$ ), PVA and/or PVB. The thermal conductivity of the  $Si_3N_4$  compounds in the structure seems to be greater than that of the  $Si_3N_4$  outdoor compounds. The thermal conductivity of  $Si_3N_4$ /PVA in-plane composites was higher for a specific  $Si_3N_4$  component compared to  $Si_3N_4$ /PVB in-plane. This could be attributable to  $Si_3N_4$ 's improved orientation because of the presence of a greater number of hydroxyl groups. The amphiphilic  $C_{14}H_{27}N_3O_2$  treatments have shown higher temperature conductivity than  $C_{27}H_{27}N_3O_2$  treatments. The evaluated thermal conductance of the composites equated to those predicted by several theoretic models. Copyright © 2021 Elsevier Ltd. All rights reserved.

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### 1. Introduction

The high degree of integration between the various components in the electronics is critical not only to preserving the device's life but also to its results and its durability [1]. Ceramic/polymer materials from the electronics field were therefore especially high to establish composites with high thermal conductivity [2]. Many previous studies have included the addition of high thermal-conductivity ceramics, perception in anisotropic ceramics and a change in the connection between pottery and polymers to improve heat conductivity of pottery-polymer composites [3,4]. In addition, a number of types of numeric models were proposed for a more efficient prediction of composites' thermal conductivity and for the development of possible new composites [5]. While the

thermal conductivity of boron hexagonal nitride (h-BN) is extensively used in polymer nanocomposites, the composite's thermal conductivity focuses heavily on the BN-platelets-anisotropy, which modifies its thermal polymer in order to adapt the Boron Nitrate, to thermal flow [6].

The inter-particle behaviour of ceramics and polymers should be monitored, on the other hand, by a technical understanding of the factors affecting them in order to develop thermally conductive composites suited to a number of applications [7]. It is especially important to control the variation of surface texture between hydrophobic pots and hydrophilic polymers by an amphiphilic agent [8,9]. The amphiphilic agent usually consists of two categories, one of which is hydrophobic and hydrophilic and the other of which is hydrophilic. The interfacial response between ceramic and polymers may be enhanced by these two groups of amphiphilic agents [10].

The thermal conductivity of the boron nitrate (B.N.) matrix is above that of pristine B.N. in early studies with the amphiphilic agent  $C_{27}H_{27}N_3O_2$ . This is consistent with a B.N. nanotubes catechetically processed report showing an increased thermal conduc-

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## Computational and biological efficacy of stigmasterol against HeLa cells and Vero cells- first time isolated from the ethanolic extract of *Annonamuricata* Linn leaves



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Molecular docking

### ABSTRACT

The present study was aimed to analyze the *In vitro* antioxidant, anti-inflammatory and cytotoxicity activities of isolated bioactive compound stigmasterol (abbreviated as STML) from the leaves of *Annonamuricata*. Extraction was done using Soxhlet apparatus, TLC, column chromatography and STML in the extracts were identified by Gas-Chromatography and Mass-Spectroscopy (GC-MS) analyses. Characterizations of isolated bioactive compound stigmasterol for purity verified were performed using High-performance liquid chromatography (HPLC) technique. Stigmasterol compound was estimated by DPPH scavenging and ABTS assay, it showed significant values. *In vitro* cytotoxicity activity of stigmasterol was also tested HeLa cells and Vero cells and IC<sub>50</sub> values found that 11.58 µg/ml and 173.8 µg/ml, respectively. The different spectral analysis were also characterized by experimental and well deal with the theoretical ab Initio Density functional theory (DFT) method at B3LYP level with 6-311++G(d,p) basis set of provides for the different spectral studies, respectively by using UV-Visible, <sup>1</sup>H and <sup>13</sup>C nuclear magnetic resonance (NMR) spectroscopy studies. Fourier-transform Infrared (FTIR) spectral analysis was carried out. Density Function Theory (DFT) computations enabled us to get different reactive properties of STML. The *R<sub>f</sub>* of STML isolated from the ethanolic extracts of *Annonamuricata* leaves is 3.707. In conclusion, the results suggest that the investigated compounds are potential drug leads to target HeLa cells and Vero cells.

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### 1. Introduction

Each year, more than 500,000 women are diagnosed with the deadly cause of cervical cancer. This disease, which is projected inside the vagina, is the fourth most frequent malignancy in women, and it is linked to the human papillomavirus (HPV) [1–4]. Treatment is determined by the stage of cancer, and many therapies, such as radiation, chemotherapy, or immunotherapy, may be used [5]. Cisplatin, carboplatin, paclitaxel, topotecan, and gemcitabine are the most often used drugs to treat cervical cancer. However, numerous side effects have been connected with the usage of these

treatments [6]. Furthermore, the expensive price of the therapies makes them inaccessible to the general public [7]. As a result, it is critical to look for new therapies that are less expensive and do not have negative effects. One of these alternatives is the employ of bioactive compounds from natural sources and, therefore, takes benefit of the biological wealth of developing countries [8].

STML is a natural 6–6–6–5 tetracyclic phytosterol, which constitutes a rigid tetracyclic backbone with one hydroxyl group at one end and one C10 branched hydrocarbon chain at the other end. It has been inspected for its pharmacological prospects, such as cytotoxic, antitumor, antimutagenic, antioxidant, anti-inflammatory, and CNS effects [9]. In our current research, STML was isolated from the leaves of *Annona muricata*. As far as we know, STML is the first report on the isolation of stigmasterol from the leaves of *Annona muricata*. Different spectral analysis, DFT-computational,

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## Novel quinoxaline derivatives of 2, 3-diphenylquinoxaline-6-carbaldehyde and 4, 4'-(6-methylquinoxaline-2,3-diyl)bis(N,N-diphenylaniline): Synthesis, structural, DFT-computational, molecular docking, antibacterial, antioxidant, and anticancer studies



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### ABSTRACT

The quinoxaline derivatives of 2, 3-diphenylquinoxaline-6-carbaldehyde (DPQC) and 4, 4'-(6-methylquinoxaline-2,3-diyl)bis(N,N-diphenylaniline) (MDBD) were synthesized using direct condensation methods, and various spectral analysis were characterized by experimental and ab initio Density functional theory (DFT) theoretical methods at the B3LYP level with 6-311++G(d,p) basis sets were used for the different spectrum analysis, which included UV-Visible, Fourier-transform infrared spectroscopy (FTIR), and <sup>1</sup>H and <sup>13</sup>C nuclear magnetic resonance (NMR) chemical shifts. Furthermore, for these title molecules, Nonlinear Optical (NLO) was utilized to compute first-order hyperpolarizability ( $\beta$ ) and Mulligan population analysis was performed. The ESI-Mass spectrum analysis was performed for these quinoxaline derivatives. In this study, title molecules of DPQC and MDBD were tested for in vitro antibacterial, antioxidant, and anticancer properties which exhibited enhanced biological activities. In particular, the title molecule MDBD gave enhanced anticancer activity at the lowest concentration of 125  $\mu$ g/mL against human liver cancer (HepG2) cell lines, as well as potent bactericidal activity with a maximum of (19.5  $\pm$  1.0 mm) at 2.5  $\mu$ g/mL against *Yersinia enterocolitica* (MTCC 840). In an (H<sub>2</sub>O<sub>2</sub>) scavenging study, MDBD revealed potent antioxidant activity (64.21%). The DPPH radical scavenging antioxidant activity of MDBD was discovered at (67.48 %) concentration at 500  $\mu$ g/mL. The best binding energy between anticancer target protein, specifically c-Met-kinase (hepatocyte growth factor; PDB ID: 3F66) and DPQC and MDBD compounds, were determined using in silico molecular docking. The auto dock software provided superior results for the title compound MDBD, which exhibited a higher ligand-receptor interaction energy value of -10.8 (kcal/mol) against 3F66 protein and a 0.01187  $\mu$ M inhibition constant (K<sub>i</sub>) with (active site A) presented amino acids such as A: ARG108E, A: MET121I, A: VAL109Z, A: ALA122E, A: ALA110E, A: MET121I. Further, studies are warranted to explore their promising anticancer and other pharmacological and biochemical properties.

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### 1. Introduction

Cancer is the main cause of morbidity and mortality worldwide, which developed because of the unregulated increase in malignant cells which can spread to different organ systems. Liver cancer is one of the main predominant diseases important

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Effect of sulfated seaweed polysaccharide on flat sheet polymer (Polysulfone) membrane properties - ScienceDirect



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## Effect of sulfated seaweed polysaccharide on flat sheet polymer (Polysulfone) membrane properties

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### Highlights

- Polysulfone / Ulvan / DME, NMP, THF, flat sheet membranes were successfully fabricated.
- Effect of solvents on membrane preparation and characterization was also investigated.
- Surface roughness factor was influenced by Ulvan (0.5–2.0 wt. %) concentration.
- Contact angle gradually decreases with increase in Ulvan concentration from 0.5–2.0 wt. %.

### Abstract

Highly sustainable green seaweed derived hydrophilic sulfated polysaccharide Ulvan was (0.5–2.0 wt. %) blended with 15wt.% polysulfone (PSf) and used as homogeneous dope solution for membrane fabrication. PSf / Ulvan polymer dope solution was prepared with four different hydrocarbon solvents, N, N dimethylformamide (DMF), dimethyl sulfoxide (DMSO), N-methyl 2-pyrrolidone (NMP) and -dimethyl acetamide (DMAc). Out of these four solvents, DMSO stood out to be an incompatible one for PSf/ Ulvan composite solution. However, PSf/Ulvan membranes were successfully fabricated with the other three solvents. Flat sheet membranes thus synthesized were characterized using pure water flux, macromolecule rejection, ATR-IR, AFM, contact angle and porosity. AFM analysis confirmed that, Ulvan influenced the surface roughness and morphology of the membranes. An appreciable change in surface roughness was noted with an increase in Ulvan concentration in the dope solution. Contact angle values were measured and it supported the behavior of Ulvan, especially the hydrophilic surface property. The effect of Ulvan as an additive (porogen) in the PSf membrane had a very high influence in the efficiency and morphological properties. Similarly, promising results were obtained with BSA rejection ranging from 78.53% to 72.36% for a time duration of 12 hours with DMAc solvent and 81.19% to 75.49% for the time duration of 12 hours with NMP as solvent. With the increase in the concentration of Ulvan from 0% to 2.5%, the flux increased from 581.8 to 991.3 LMH with DMAc as solvent. Similarly, with NMP as a solvent, the flux increased from 571.8 to 974.8 LMH.





## AI Based COVID Pneumonia Classifier Using Machine Learning

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### Abstract

To classify and detect the presence of pneumonia or COVID-19 in a series of chest X-ray images, this research presents a convolutional neural network model that was trained from the ground up. Many other methods use transfer learning or handcrafted methods to attain a high level of accuracy in classifying data. Pneumonia or COVID-19 can be diagnosed using a convolutional neural network model that extracts information from the provided chest X-ray image and classifies it. The reliability and interpretability issues that arise frequently when dealing with medical images may be alleviated by using this method. Pneumonia datasets are scarce for this classification assignment, as they are for other deep learning classification tasks that require a huge image library. To increase the CNN model's validation and classification accuracy, we applied a variety of data augmentation strategies. We were able to achieve outstanding validation accuracy.

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## DEPARTMENT OF SCIENCE AND HUMANITIES

ACADEMIC YEAR - 2021-2022



10/10/22, 9:47 AM An Intelligent Cooling System Based on Predictive Time Domain Algorithm with Thermoelectric Coolers for Wind Turbines | IJETA

Development of Power Electronics devices (PED) made renewable energy generation of power more feasible than that of traditional power plant generation. In India, Tamil Nadu the major source of renewable generation is come from Wind generation. Due to PED, heat generated is the Major issues in wind power generation, which consequence in terrible combustion accidents and disasters. Cooling system such as compressor based cooling scheme or two phases cooling is provided in addition to natural air cooling. The major disadvantages of the scheme are their volume, requirement of large power supplies and frequent chance to catch fire. Currently, using Thermo-electric coolers (TEC) called Peltier modules to provide cooling in wind power plant. Only after the system has reached massive temperature levels can it excavates the heat. The proposed method using predictive time domain algorithm the cooling process initiated in prepone manner. As soon as heat go up the system will detected and switched on cooling in predictive manner which can avoid the system to reach the maximum temperature. By using IoT, the system can monitor the temperature level and make use of predictive cooling technology over the surfaces without any delay time.

### Keywords:

thermoelectric, wind turbine & time domain algorithm

#### 1. Introduction

#### 2. Design of Proposed System

#### 3. Experimental Results and Analysis

#### 4. Conclusion and Future Work

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