3.4.5 Number of research papers per teacher in the Journals notified on UGC website during the last five yea

S.No	Title of paper	Name of the author/s	Name of journal	Year of publication	Web of Science/Pub med/Scopus /SCI
1	Chitosan-PVP- nano silver oxide wound dressing: In vitro and in vivo Evaluation	Archana D, Singh BK, Dutta J, Dutta P.K.	International Journal of Biological Macromolecules	2015	Yes
2	Preparation of chitosan-gelatin based composite gels/films as wound cover materials	Gayatri and Dutta J.	Asian Chitin Journal	2015	Yes
3	Effect of addition of Hydrophobic Hydrocarbons on the Hygroscopic Tendency of Ammmonium Nitrate Crystals	Bharti MK, Aggarwal R, Kami P, Pathak SR, Soni M.	International Journal of Current Engineering &Techonology	2015	Yes
4	Structural & Functional aspects of Trypsin-Gold Nanoparticle Interactions: An Experimental Investigation	Nidhin M, Ghosh D, Yadav H, Yadav N, Majumder S.,	Material Science and Engineering B	2015	Yes
5	Effect of radiative heat transfer term in weak non linear waves in fluid	Nahid fatima	Asia pacific journal	2015	
6	Effect of radiativer heat transfer on compression pulses in steay fluid in internal state varibles	Pandey K, Fatima N	International Journal of Applied Engineering Research	2015	Yes
7	Reliability Analysis Programmable Logical Control (PLC) System with Two Repairmen	Kumar V	YMCAUST International Journal of Research	2015	
8	Mathematical Modeling of Feedback Bitandam Queue Network with Limkage to Common Channel	Bhardwaj R, Singh T. P, Kumar V	Aryabhatta Journal of Mathematics and Informatics	2015	Yes
9	Overview of Genetic Algorithm Technique for maximum Power Point Tracking(MPPT) of Solar PV System	Yadav A, Jha A, Arora R	International Journal of Compter Applicatins	2015	Yes
10	Maximum Power Point Tracking of Solar Photovoltaic System using Artificial Neural Networks	Yadav S, Kumar M, Arora R	International Journal of Computer Applications	2015	Yes
11	Multi-objective thermodynamic optimization of an irreversible regenerative Brayton cycle using evolutionary algorithm and decision making	Kaushik S C, Kumar R, Arora R	Ain Shams Engineering Journal	2015	

12	Performance optimization of two stage exoreversible thermoelectric converter in electricalli series and parallel configration	Arora R, Manikandan S, Kaushik S C	Journal of electronic materiaal	2015	Yes
13	Study of Magnetic behaviour in balll milled nanocrystalline Fe-50%AL alloy as a function of milling time	Archana, Brijesh K Singhm,Ranjeet Brajpuriya,Anupam Vyas	Moern Physics Letter B (In press)	2015	Yes
14	Structural and magnetic stability of high energy ball milled Co2 MnSi	Sudheesh V D, Sebastian V, Lakshmi, Venugopalan K,Vinesh A	Journal of Magnetism and Magnetic materials	2015	Yes
15	A Cultivated Differential Evolution Algorithm using modified Mutation and Selection Strategy	Pooja, Chaturvedi P, Kumar P	Innovative Systems Design and Engineering	2015	
16	Effect of Addition of Hydrophobic Hydrocarbons on the Hygroscopic Tendency of Ammonium Nitrate Crystals	Manish Kumar Bharti, Rupesh Agarwal, Pranay Kamit, Seema R. Pathak, Mohit Soni	International Journal of Current Engineering and Technology	2015	Yes
17	Design of a standalone Photovoltaic System for a Residential Building in Gurgaon	Milan Palor A, Raju N B, Das S	Sustainable Energy	2015	Yes
18	Analytical Model for Determning the Sun's Postions at all Time Zones	Milan Pal A, Das S	International Journal of Energy Engineering	2015	Yes
19	Multi-Objective and multi-parameter optimization of tow-stage thermoelectic generaton electrically series and parallel configrations through NSGA-II	Arora R, Arora R	Eneragy	2015	Yes
20	Fuzzy bi-criteria problem of clustering ration shops to warehouse	Tuli R, Sharma V, Singh S	International Journal of Knowledge and Research in management & E-Commerce	2015	
21	A Conserved W91 residue determines the packing of Kunitz (STI) family of inhibitors Theoretical & Experimental Investigation	Majumder S, Khamrui S, Banerjee R, Bhowmik P, Sen U.	Biochimica et BiophysicaActa (BBA)-Proteins and Proteomics	2015	Yes
22	Mechanically induced phase transformation and magnetic properties of nanocrystalline Fe-50% AL alloy	Sandeep Ranjan, Rajni Shukla, Anil Kumar, Anupum Vyas, Pankaj Ranjeet Brajpuria	AIP Conference Proceeding	2015	Yes

23	Evolution of magnetic order in nanocrystalline Fe-50% AL alloy during ball milling of elemental powders	Sandeep Ranjan, Rajni Shukla, Anil Kumar, Anupum Vyas, Pankaj Ranjeet Brajpuria	AIP Conference Proceeding	2015	Yes
24	FraaS: A Framework for Digital Forensic Services in a Cloud-based Environment	Mohit Soni M, Bharti M K	The International Journal of Forensic Computer Science	2015	
	Dopant Segregation and Heat Treatment Effects on the Electrical Properties of Polycrystalline Silicon thin Films	B. Zaidi, B. Hadjoudja, C. Shekhar, B. Chouial, R. Li, M. V. Madhava Rao, S. Gagui, A. Chibani	Silicon	2015	Yes

Chitosan-PVP-nano silver oxide wound dressing: in vitro and in vivo evaluation.

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Abstract

The main aim of this work was to prepare wound healing material with chitosan, poly vinyl pyrrolidone (PVP), silver oxide nanoparticles. The prepared chitosan, chitosan-PVP-nano silver oxide (CPS) films were characterized for their thermal behaviour, morphological properties, mechanical properties, antibacterial properties and wound healing properties. The CPS film found higher antibacterial activity because the materials both chitosan as well as silver oxide poses good antibacterial activity. L929 cell line were for cytotoxicity study and Adult male albino rats (140-180 g) were used for wound healing study. The prepared film has more wound healing property than of cotton gauge, 100% chitosan and other reported chitosan based dressings.

KEYWORDS: Chitosan; PVP; Silver oxide; Wound dressing

MeSH terms, Substances

LinkOut - more resources

Preparation of chitosan-gelatin based composite gels/films as wound cover materials

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ABSTRACT

In this study, chitosan-gelatin based composite gels/films were prepared as wound cover materials by solution casting technique. Propylene glycol served as a plasticizer as well as a humectant. The gels as well as films were studied with the measurement of percentage swelling, percentage weight loss, thickness, and folding endurance. The chitosan-gelatin based composite gel (1:50) has maximum percentage swelling and percentage weight loss as compared to composite film at 37°C. On the other hand, percentage weight loss of chitosan-gelatin based composite film (2:5) is significantly less as compared to the composite gel. In addition, the folding endurance of the film is more than that of the gel. Further, it is attributed to the fact that the film possesses better mechanical strength as compared to the gel. The chitosan-gelatin based composite film (2:5) may be used as a promising wound cover material.

Key Words: Chitosan, gelatin, composite gels/films, wound cover

INTRODUCTION

Even without the aid of any wound cover materials, a wound can heal itself through a natural healing process. Nevertheless, covering a wound is essential to protect the wound from microbial contamination that may be detrimental for overall human health. Keeping these issues in mind, the researchers are looking for new materials for the development of wound covers with new properties. Chitosan is a natural and hetero-polymer of glucosamine and N-acetyl glucosamine residues and is obtained by deacetylation of chitin[1-3]. Owing to its non-toxic characteristic, biocompatibility, biodegradability, and anti-bacterial activity, it has attracted significant interest in a wide range of biomedical and pharmaceutical applications including drug delivery, cosmetics, wound healing, and tissue engineering, to name a few[4-6]. The primary hydroxyl and amine groups located on the backbone of chitosan are mainly responsible for the reactivity of the polymer and also act as sites for further chemical modification[1,4]. On the other hand, gelatin is also a natural biodegradable polymer derived from collagen of animal skin and bones. Due to its easy film as well as gel forming abilities, it can be combined with chitosan so as to obtain film or gel with improved properties essentially required for treating wounds[7]. The present investigation has demonstrated not only the preparation of chitosan-gelatin based wound covers in the form of gels and films using solution casting technique but also their characterization in terms of swelling study, weight loss study, thickness and folding endurance measurements.

MATERIALS AND METHODS

Chitosan with a molecular weight of 100,000 was obtained as a gift sample from Central Institute of Fisheries and Technology, Cochin. Gelatin and propylene glycol were procured from Central Drug House, New Delhi. All chemicals were used as received without further purification.

PREPARATION OF GELS/FILMS

First of all, chitosan (1-3%) (w/v) and gelatin (10-20%) (w/v) solutions were prepared separately in respective 1% (v/v) glacial acetic acid and distilled water. Then chitosan and gelatin solutions were mixed together in various proportions and allowed to leave at ambient temperature until all the airbubbles disappeared. Subsequently, 0.25 mL of propylene glycol was added separately in various proportions throughout the experiments. Finally, these solutions were poured into plastic trays for the formation of gels and air dried at room temperature in case of films.

CHARACTERISATION OF GELS/FILMS

The chitosan-gelatin based composite gels/films were characterized by measuring the thickness, folding endurance, percentage swelling and weight loss using conventional methods described elsewhere[8].

RESULTS AND DISCUSSION

Thicknesses of the obtained gels as well as films were measured by screw gauge. The thickness of the gel was in the range between 1.26 mm and 3.13 mm whereas the film thickness was 0.25 mm that indicated the uniform spreading of the solution during casting. Folding endurance of the chitosan-gelatin composite film (2:5) was remarkably higher (300 times) than the chitosan-gelatin composite film (1:40) reported by Hima Bindu et al.[8] and it was 256 ± 5.50. It may be due to the presence of propylene glycol, the flexibility of the current composite film has

Research Article

Effect of Addition of Hydrophobic Hydrocarbons on the Hygroscopic Tendency of Ammonium Nitrate Crystals

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Abstract

The present study is aimed towards the use of selected hydrophobic hydrocarbons to attain a waterproof coating on Ammonium Nitrate crystals. High hygroscopic nature of Ammonium Nitrate makes it impractical for its use as oxidizer in composite solid propellant formulations as absorption of water molecules by Ammonium Nitrate from moisture in the atmosphere negatively affects the structural integrity, energetics and ballistic performance of the Ammonium Nitrate based propellant grains. Hydrocarbons, generally waxes and oils, are hydrophobic in nature and may thus be utilized to repel water molecules resulting in a reduced water absorption by Ammonium Nitrate crystals. In the present study, the effect of addition of Paraffin Wax, Micro-crystalline Wax & Bees Wax along with pure Ammonium Nitrate is observed and compared. Samples were prepared by adding varying and significantly small weight percentages of waxes with Untreated Ammonium Nitrate and were kept under normal laboratory conditions. A weight increment rate study of all the prepared samples were conducted on a daily basis for a period of 20 days. All prepared samples, under same atmospheric conditions, exhibited different water absorption rates which were then compared to reveal the waterproofing capabilities of specific additives.

Keywords: Ammonium Nitrate, Hydrophobic Hydrocarbons, Paraffin Wax, Micro-crystalline Wax, Bees Wax, Waterproofing.

1. Introduction

Ammonium Nitrate (AN), though being an economical and eco-friendly oxidizer, suffers a very limited use in the formulations of composite solid propellant (CSP) grains due to its high hygroscopic nature. The Nitrate salt of Ammonium with chemical formula NH_4NO_3, with appearance of white crystalline solid, is highly soluble in water (Zapp et al, 2000). Ammonium Nitrate tends to absorb water molecules from moisture present in the atmosphere which results in liquefaction and/ or a change in state of the compound. Another major drawback of AN is its dimensional instability due to its five phase state transitions ranging from -200 °C to its boiling point, i.e. 125 °C. These phase modifications leads to a decrease in the adherence between the crystallites and result in severe structural changes in the crystal lattice of Ammonium Nitrate (Hendricks et al, 1932), (Brown et al, 1962). Owing to these inherent shortcomings, structural strength of AN based propellant grains decrease significantly during these thermal cycles and leads to the formation of cracks in the propellant grains.

Such cracks result in an unexpected increase in burning surface area of the propellant (Flack-Muss et al, 1972). At any instant, mass flow rate of hot gases generated and flowing from the motor under stable combustion conditions is governed by the following empirical formula (Sutton et al, 2001):

$$\dot{m} = \rho p. Ab. r \qquad (1)$$

Where,

$\dot{m}$ = mass flow rate of hot gases generated,
ρp = density of propellant prior to motor start,
Ab = burning area of the propellant grain,
r = propellant burn rate.

Formation of cracks in the propellant grains open up new additional burning surfaces causing an unexpected increase in the generation of mass flow of hot gases as is evident from Equation 1. Such increased mass flow may over pressurize the solid rocket motor (SRM) leading to a disastrous failure of the mission. Hence, any inherent property of an ingredient used in the formulation of CSPs which may lead to occurrence of cracks, should be diminished.
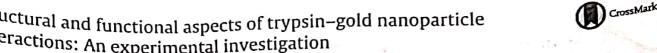
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Structural and functional aspects of trypsin–gold nanoparticle interactions: An experimental investigation

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ARTICLE INFO

ABSTRACT

Trypsin (Trp) is arguably the most important member of the serine proteases. Constructs made up of gold nanoparticles (GNP) with trypsin have been known to exhibit increased efficiency and stability in various experiments. Here we report simple Trp–GNP constructs mixed in different trypsin-to-GNP ratios which exhibit higher efficiencies in biochemical assay. Varying resistance to autolysis and higher ability in cell trypsinization. Trp–GNP constructs in different trypsin-to-GNP ratios exhibit prolonged and sustained activity compared to native trypsin in N-α-p-benzoyl-p-nitroanilide (BAPNA) assay as monitored by UV-Visible spectroscopy. The activity was monitored as a function of decreasing rate of linear release of p-nitro aniline (resulting from the cleavage of BAPNA by trypsin) with time during the assay, whose absorbance was measured at 410 nm (λ_{max} p-nitro aniline). We have done extensive studies to understand structural basis of this trypsin GNP interaction by using atomic force microscopy (AFM), transmission electron microscopy (TEM) and circular dichroism (CD) techniques. Our findings suggest that on interaction, the gold nanoparticles probably form an adherent layer on trypsin that effectively changes the morphology and dimensions of the nanoconstructs. However, trypsin-to-GNP ratio is extremely important, as higher concentration of GNP might damage the conformation of protein. Stability studies related to denaturation show that 1:1 Trp–GNP constructs exhibit maximum stability and high efficiency in all assays performed.

1. Introduction

Trypsin is arguably the most important member of the Serine Protease clan. It has wide implication in different biochemical techniques like limited proteolysis, residual enzymatic activity and proteolytic assays [1–6]. Besides, trypsin is a key player in the digestive system of different species from mammals to reptiles, Pisces and even plants. The structure of trypsin from different sources is well established [7,8]. Apart from some minor sequence difference, the overall structure is almost the same. The structure of trypsin consists of mainly antiparallel β-sheets and loops with sporadic presence of two small α-helices. Asp 189 residue in the trypsin pocket is believed to determine its high substrate specificity and strong biochemical property [9]. In spite of its importance, trypsin has many drawbacks especially autolysis (self-digestion in solution), poor enzyme-to-substrate ratio that often becomes problematic during protein identification, and extremely small half life in biochemical assay disallowing long-time studies with minimum reagent quantity [10,11]. Multi-dimensional approaches have been implemented to increase the enzyme efficiency and reduce the auto-digestion. Various developments in this field include the sol–gel encapsulation, immobilization of enzyme on monolith surface, and construction of open tubular enzyme reactor [12–14].

Interaction of nanoparticles (NPs) with proteins nowadays has become immensely interesting for researchers considering the biological importance of proteins in every living system. The nano-protein complex is generally referred to as nanoparticle-protein

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EFFECT OF RADIATIVE HEAT TRANSFER TERM IN WEAK NON–LINEAR WAVES IN FLUID WITH INTERNAL STATE VARIABLES

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Abstract: In the current research work, we have attempted to discuss the effect of radiative heat transfer term in weak–non–linear waves in fluid with several internal state variables.The analytical method of characteristics is used to show that a plane finite amplitude disturbance propagates through this system at the frozen sound speed.

Key Words: Radiative Heat Transfer, Non Linear Waves, Fluid

I. INTRODUCTION

Several articles[2,3,4,5,7]trade with the solution of plane shock waves formation in one dimensional unsteady flow with discontinuities resulting from the motion of a piston. Clark[5] discussed growth and decay behavior of plane waves travelling through a relatively uniform but time relying chemically reactive gas mixture in a general state of disequilibrium.In classical mechanics of an inviscid non heat conducting gas the shock wave is a sharp discontinuity of the velocity and the thermodynamics variable of thegas. Sharma and Shyam[12] discussed behavior at the wave head of a finite amplitude gas dynamic disturbance in a chemically reacting fluid. Pandey and Chaturvedi[11] have also discussed weak waves in reacting gases. Ojha and Tiwari[10] decidedpropagation of spherical shock–waves in non–ideal atmosphere. In many important occurrences,it is necessary to envisagea flow of a gas with sufficiently large and rapid temperature changes deviate from thermodynamics equilibrium because some degree of freedom in the molecules cannot follow these changes without lag. the processes, in which there occurs the motion of the mixture or various gases and fluids, or gases and fluids with solid particles, or fluids only, accompanied by chemical phase or some other transition and the phenomena of diffusion, representing itself the internal relative motion of substances constituting the mixture.A gas is considered as having a number of modes of molecular energy, such as translation, vibrational and electronic. For some application, the population of the energy levels in each mode may often be assumed to follow Boltzman distribution. Thus, each mode can be characterized by a temperature and a given internal mode is said to be in equilibrium if its temperature is equal to that of translation mode. If all internal modes are in equilibrium, the gas is said to be in internal equilibrium. When a radiative field is associated with the gas, we define "radiative-equilibrium". Similarly, when a gas is chemically reactive, we can define chemical equilibrium.

Chemistry, especially chemical kinetic processes and aerospace engineering have become intimately linked because of mutual interests.Aerospace engineers have required the chemist guidance in a whole variety of re-entry problems, whereas the chemistry have found many of the simulation techniques used by the engineers capable of extension to the study of purely chemical processes.

In the absence of transport effect, equation governing the conservation of mass, momentum, energy and rate equations for one dimensional motion of a flow with several internal state variables are given by

$$\rho_{,t} + u\rho_{,x} + \rho u_{,x} + \frac{\in \rho u}{x} = 0 \quad (1.1)$$

$$\rho u_{,t} + \rho u u_{,x} + p_{,x} = 0 \quad (1.2)$$

$$p_t + u p_x + a_f^2 \left(\rho u_x + \frac{\varepsilon \rho u}{x}\right) - \frac{1}{\rho} a_f^2 \sum \rho_{ci}\omega_i + Q(\Gamma - 1) = 0 \quad (1.3)$$

$$c_{i,t} + u c_{i,x} = \frac{w_i}{\rho}, (i = 1, ..., N). \quad (1.4)$$

where ρ, u, p, h, , 'c_i' and w_i are density, velocity, pressure, enthalpy, concentration of the ith species x is the distance of the axis or the centre of symmetry and w_i rate of production of ith species respectively. The frozen sound speed a_f can be written as

$$a_f^2 = (p_{,\rho})_{S,c_i} = \frac{\rho h_{,\rho}}{1 - \rho h_{,p}} \quad (1.5)$$

Effect of Radiative-Heat Transfer on Compression Pulses in Steady Fluid with Internal State Variables over a Concave Wall

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Abstract: In the present paper, following Jejjery[6] and Ravity[14] an attempt has been made to discuss the effect of radiative–heat–transfer term at which the jump continuity first appears on the compression pulses in steady fluid with several state variables over a concave wall in two–dimensional steady supersonic flow. Optically thin gas approximation and method of natural coordinates is used to determine explicit criteria for the breaking or non–breaking of the wave profile.

However, the results corresponding to binary dissociated gas is also obtained and discussed.

Key Words: Radiative heat transfer compression pulses, internal state variable.

I. INTRODUCTION

The effect of non–linearity on the wave propagation has been a subject of great interest from mathematical as well as physical point of view. The studies of non–linear effects on the wave propagation have been extensively carried out by several authors[4,6,9,12,15,17,18,19,22]. Equations of state with one state dependent state variable arise in the study of gases subject chemical dissociation or vibrational relaxation. In the former case, the possible effects of diffusion are normally neglected so that the purely chemical phenomenon is treated in isolation.

For one relaxing mode Lighthill[7] has discussed fully and partially dispersed waves. When more than one relaxing mode is concerned, often one relaxing time is extremely long compared with others, it is then useful to assume that all short relaxation time modes are in equilibrium, reducing the problem to one of the single mode type. Clarke and Rodgers[3] have investigated the structure of plane–steady shock wave in a gas with several internal energy modes. Becker and Böhome[1] have discussed the structure of compression wave for n–parallel relaxation modes. Coleman and Gurtin[4] have discussed growth and decay of discontinuities in fluid with internal state variables.

Effect of radiation are of great significance in astrophysical problem and nuclear explosions. In extremely high speed of flight of a space–craft re-entering planetary atmospheres, the gases in motion attain high temperature and radiation becomes an important mode of heat transfer. It was pointed out by Schwarzschild[16] and re–emphasized by Eddington[5] that radiative–transfer could play an important role not only in stellar–atmospheres, but also in stellar–interiors. Vincenti and Baldwin[19] studied the effect of thermal–radiation on the plane–acoustic–waves. Wang[20] studied the 'Piston Problem' with thermal radiation. Role of radiation in modern gas dynamics was discussed by Ziqulev[23]. Olfe[10] has studied the effect of radiation on unsteady shock–wave. Srinivasan and Ram[13] have discussed the sonic–discontinuities in radiating–gases. Ojha and Rai[8] have studied growth and decay of weak discontinuities in presence of thermal radiation.

Equation of motion for a two–dimensional steady fluid with several internal state–variables when radiative heat transfer is taken into account and other forces such as viscosity heat conductivity etc. are neglected are given by

$$u\,\rho_{,x} + v\rho_{,y} + \rho(u_{,x} + v_{,y}) = 0, \tag{1.1}$$

$$\rho u u_{,x} + \rho v u_{,y} + + p_{,x} = 0, \tag{1.2}$$

$$\rho u v_{,x} + \rho v v_{,y} + p_{,y} = 0, \tag{1.3}$$

$$u\rho_{,x} + v\rho_{,y} - a_f^2(u\rho_{,x} + v\rho_{,y}) - \sum_{i=1}^{N}\left(\frac{h_{,c_i}\,w_i}{1 - \rho h_{,p}}\right) + Q\rho(\Gamma - 1) = 0, \tag{1.4}$$

$$u c_{i,x} + v c_{i,y} = \frac{w_i}{\rho}. \tag{1.5}$$

$$i = 1,2,\ldots,n).$$

Where u,v,p,ρ,h, C_i and W_i denote respectively x and y component of velocity, gas pressure, density, enthalpy, concentration, rate production. Radiative heat–transfer term Q is given by

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Reliability Analysis of Programmable Logical Control (PLC) System with Two Repairmen

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ABSTRACT : This paper describes the cost-benefit analysis of programmable logical control (PLC) system, which is generally used in the modern industries. The model of system consists basically three parts i.e. mechanical part (M), software (S) and control processing unit (H) and also two repairman. One is ordinary repairman and other is expert repairman. Initially, ordinary repairman starts the repair of failed unit, if he is not able to repair the failed unit then he will discuss with the expert repairman. The failure time distributions of components are taken exponential whereas the repair time distribution is general. Using regenerative point technique, important measures of system effectiveness are obtained. The results are also analyzed through graphs in a particular case when repair time distributions are also exponential.

KEYWORDS : PLC, exponential distribution, regenerative point technique, failure & repair rate, p.d.f, c.d.f, etc.

1. INTRODUCTION

In order to improve the profit of an industry, researchers are always interested in analyzing the real existing industrial system models. Arora et al (2000), analysis the system and maintenance management for coal handling system in paper plant, Gupta et al. (2004) studied the reliability of gas leakage detection system in an industrial workshop, Dillon, B.S. et al. (1980) analyzed availability analysis of systems with two types of repair facilities.

In this era most of the industries are based PLC system. As we can understand by the name programmable logical control system is the combination of three different units. The first unit is mechanical (M) part, second is software (S) and control processing unit (H).

Application of PLC technology has raised the level of automation in logical control systems. It has made it much more productive, flexible, expandable and convenient to operate. The need of logical control machines was felt for machining complex-shaped small batch components as those belonging to an aircraft. The first demonstration of this prototype was held in 1952. Later on, several commercial PLC units were introduced into the market machine builders serving a variety of applications. PLC machine have been found quite suitable where,

(i) the components have complex shapes

(ii) the parts are to be made in small batches

(iii) the inspection cost is a significant portion of the total cost

(iv) high productivity

(v) lower costs of production

(vi) Flexibility in manufacturing.

The system has been analyzed by making use of semi-Markov process and regenerative point technique.
- Save energy by directing signals only towards the intended direction.

1.1 NOTATION AND STATES OF THE SYSTEM

F	:	Set of regenerative state
		$\{S_i, i = 0, 2, 3, 4, 5, 6, 7, 8, 9\}$
E	:	Set of non-regenerative state
		$\{S_j, j = \text{null}\}$
α	:	Failure rate of mechanical unit
β	:	Failure rate of control processing unit
γ	:	Failure rate of software unit
$g_1(t), G_1(t), h_1(t),$ $H_1(t), k_1(t), K_1(t)$	:	p.d.f. and c.d.f. of repair time of repairman for mechanical part
$g_2(t), G_2(t), h_2(t),$ $H_2(t), k_2(t), K_2(t)$	:	p.d.f. and c.d.f. of repair time of repairman for control processing unit
$g_3(t), G_3(t), h_3(t),$ $H_3(t), k_3(t), K_3(t)$	:	p.d.f. and c.d.f. of repair time of repairman for software part
P_1, P_2, P_3	:	Probabilities
q_1, q_2, q_3	:	Probabilities for failure

MATHEMATICAL MODELING OF FEEDBACK BITANDEM QUEUE NETWORK WITH LINKAGE TO COMMON CHANNEL

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ABSTRACT :

The present paper makes an attempt to model a network of queues in which a common service channel is linked with each of two biserial channels along with a feedback from common channel i.e., arrival and service pattern both follow poisson distribution. All the activity in the system is performed under stochastic environment. The differential difference equations have been framed for the model and steady state behavior of the system has been studied.

The system performance characteristics have been determined by using generating function technique, laws of calculus, statistical formulae of marginal distribution etc. Numerical illustration has been given to demonstrate the result. The model finds its application in industries, banking system, administrative setup, computer network, super markets and many other business service systems.

Keywords: - *Steady state behavior, Bitandem queues, Feedback, Marginal distribution, Poisson law*

1. Introduction:

A queue network can be termed as a collection of service centers organized in such a way that the customers may proceed from one facility to other in order to fulfill their demands. Feedback concept relate to those queues in which a customer served once when his service becomes unsuccessful and are served again and again till it become successful. Many real life situations can be modeled as a feedback biserial queue network.

A vast amount of research in the field of serial and biserial queue network has been conducted by researchers during the past several decades. Jackson (1957) first showed the solution of steady state queue network system is of product form.Koiengsberg (1958) investigated the buffer storage problem as a system of cyclic queues. Finch(1959) extended the work of cyclic queues with feedback. Maggu (1970) introduced the concept of bitandem in queuing theory. Later on the work was extended by Singh T.P etal (1996, 2005), Singh T.P and Vinod (2005) studied the transient behavior of a queue network with parallel biseries queue linked with a common channel. Singh T.P and Kusum(2010) discussed feedback queue model under different parameters. Further Singh T.P and Arti (2012) discussed more generalized feedback serial queue network with different angles and augmentation.

This work is an extended generalized work as it combines both the concepts bitandem and feedback together. There is a network of queues in which the common channel is linked in a series with two distinct service channels which are biserially linked to each other.There is a feedback service from the common channel to each of channel. The feedback arises due to unsuccessful service to make successful one from the initial stage. All the activities in the system are performed under stochastic environment. It means the arrival follow Poisson distribution at each channel and the service times are distributed exponentially at each channel. The various system characteristics have been explicitly found using generating function technique, laws of calculus, L' Hospital's rule and statistical formulae. Numerical illustration has been given to demonstrate the result.

Overview of Genetic Algorithm Technique for Maximum Power Point Tracking (MPPT) of Solar PV System

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ABSTRACT

The power generation capacity of solar photovoltaic systems (SPV) depends on input solar radiation (insolation) and ambient temperature. To improve the design efficiency of the system, maximum power point tracking (MPPT) techniques has to be utilized while installing SPV systems. A comparative analysis of three maximum power point tracking techniques for solar photovoltaic systems has been presented in this paper. Along with this, various advantages of using genetic algorithm (GA) as a MPPT approach for SPV systems has been projected. The proposed methods are taken from the literature from previous research articles to the earliest applied ones and it has been revealed that three distinct methods are implemented with number of variations. The present study can become a bench mark for designing of practical SPV systems with considerable improvement in efficiency.

General Terms

Genetic Algorithm, MPPT, P&O and Incremental Conductance

Keywords

Solar PV System, Open Circuit Voltage, Short Circuit Current.

1. INTRODUCTION

Due to rapidly developing economy, world today requires new sources of energy as conventional fuels are going to get vanished soon. Moreover the degradation and damage caused to the environment cannot be ignored now with the view of disturbed ecological balance. The main drawback of using renewable energy sources is low not upto the mark performance parameters. The attractiveness of using solar photovoltaic systems is increasing rapidly because of its well designed situation for existing distribution systems [1]. The power generated by SPV systems is dominated by operating voltage of module or an array. The performance improvement of SPV systems can be done by tracking the maximum power point for it. A PV maximum power point (MPP) varies with input solar insolation and temperature and P-V curve indicates a distinctive point at which it delivers maximum power with peak efficiency [2]. Consequently, many methods have been developed to determine MPP which varies in the level of effectiveness, cost, hardware realization and their complexity of application [3,4]. In the current study, the methods explained below are chosen for investigation as

-Perturb and Observe (P&O) [5]: In this scheme, for each value of voltage and current measurement of PV array, the voltage value is increased or decreased to move towards the maximum power point. Due to very good results obtained and less complexity involved this method has got much popularity. The problem with this method is time taken for

computation which eventually depends on initial conditions of the system and oscillations around the MPP.

Incremental conductance [6]: In this method the MPP of a SPV can be obtained by comparing incremental and instantaneous conductance ($\frac{I}{V}$ and $\frac{dI}{dV}$).

1. $\frac{dP}{dV} > 0$ or ($\frac{dI}{dV} > -\frac{I}{V}$) to the left of MPP

2. $\frac{dP}{dV} < 0$ or ($\frac{dI}{dV} < -\frac{I}{V}$) to the right of MPP

3. $\frac{dP}{dV} = 0$ or ($\frac{dI}{dV} = -\frac{I}{V}$) at the MPP

This method is very helpful in dealings for actual search in MPP in coherence with changing atmospheric conditions. But during its implementation we come across the basic problem of oscillations present around MPP as we are trying to achieve

$$\frac{dP}{dV} = 0$$

So some unwanted disturbance can move away the MPP. In this method a linear relationship between V_{oc} and maximum voltage point V_{mp} and between I_{sc} and current of maximum power I_{mp} is assumed.

$$V_{mp} = M_v V_{oc} \qquad (1)$$

$$I_{mp} = M_c I_{sc} \qquad (2)$$

Where M_c is the current factor and M_v is the voltage factor. This is a very simple method but actually the assumptions of linearity in eq.1 and eq.2 are not practically viable because of non-linearity of PV model influenced by input solar insolation and ambient temperature.

2. THE MODEL

The equivalent circuit of a single-diode SPV model is shown in Fig.(1) on which all three proposed MPPT techniques are applied. In Fig.1, where R_s and R_{sh} are respectively the shunt and series resistances of the cell, usually the value of R_{sh} is very large and R_s is very small, hence they may be neglected. So characteristic equations of solar cell PV model can be written:

$$I = Iph - Irs\left(\exp(\frac{qV}{akT}) - 1\right) \qquad (3)$$

Maximum Power Point Tracking of Solar Photovoltaic system using Artificial Neural Networks

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ABSTRACT

Solar energy is clean and renewable source of energy and its decentralized property is appropriate well at the scattered state of the zones with low density of population. The cost of electricity from the solar array system is comparatively more than the electricity from the utility grid. Therefore, it make sense to operate the PV system at maximum efficiency by maximum power point tracking (MPPT)at any given environmental condition. In this work, the neural network (NN) back propagation algorithm is used to control the operation of the PV array for maximum power point extraction. Two error functions are used. The first is classical error function and the second is a modified error function which takes into consideration the derivative of the error function also. The results obtained are compared and discussed in the current study.

General Terms

Neural Network, MPPT technique, Solar Photovoltaic System.

Keywords

Open circuit voltage, short circuit current.

1. INTRODUCTION

From last few years, whole world is experiencing aimmense need for additional energy sources so as to reduce dependency on conventional sources. Solar photovoltaic (SPV) systems could be a viable solution for this problem. Renewable energy sources like wind power systems or solar power systems etc. are getting very popular for many applications in the last four decades. It is not easy to deliver electrical energy for small applications in remote areas from the utility grid or from small generators. Stand-alone solar photovoltaic (PV) systems is one of the best solutions in many small electrical energy demand applications such as telecom, water irrigation and low power appliances in rural areas. In addition, solar energy is clean, renewable and can be utilized where it is available with its decentralized characteristics. As a result, it can add to the environmental protection and be regarded as an alternative with a future to conventional energies. There are two ways to generate electricity from sun through photovoltaic (PV) and solar thermal route. Generally, PV systems can be divided into three categories stand-alone, grid-connection and hybrid systems. For places that are far from an electric power supply, stand-alone PV power systems has been considered a good alternate. Many maximum power point tracking (MPPT) techniques have been proposed, analyzed, and implemented. They can be defined in order to overcome the undesired effects on the output PV power and produce its maximum power; it is possible to insert a DC/DC converter between the PV generator and the batteries, which can control the seeking

of the MPP, besides the typical functions assigned to controllers are included. These converters are normally named as maximum power point trackers (MPPTs)[1, 2].The cost of electricity from the solar array system is much expensive compared to electricity from the national grid. Therefore it is necessary to study carefully the performance and efficiency of the entire solar PV system to design an efficient system to cover the Electricity demands with lower price. There are various external and internal factors which have an effect on the efficiency of the Solar PV panel. A resilient control using a PI regulator is used to track this maximum power point. By using Bode method the PI regulator used to control the boost DC/DC converter is synthesized by frequency synthesis. An intelligent and artificial technique to determine the maximum power point (MPP) based on artificial neural network is detailed as below. Though the approach is compared to perturb and observe (P&Q) method. The MPPT using artificial neural network proposed can surely reduce the noises and oscillations as generated by classical methods and can be a winner against other MPPT algorithms [3,4]. Also other researchers have presented a method for the control of the PV system through the MPPT using Fuzzy Logic controller. This method succeeds to lower the PV array area and increase their output, and used for control of MPPT for stand-alone PV solar system giving a minimum cost. Developed controller can be better by changing the form of the functions of memberships as well as the number of subsets [5]. Also a neuro-fuzzy controller (NFC) is designated to track the MPP. It takes advantage in conjunction with the reasoning capability of fuzzy logical systems and the learning capability of neural networks. A gradient estimator based on a radial basis function neural network is created to provide the reference information to the NFC. The parameters of NFC are updated adaptively with a derived learning algorithm. From the traditional fuzzy control the Neural Fuzzy logic is initialized using the expert knowledge, which lowers the burden of the lengthy pre-learning with a derived learning algorithmby observing the tracking errorsthe parameters in the NFC are updated adaptively. A radial basis function neural network (RBFNN) is designed to provide the NFC with gradient information, which reduces the complexity of the neural system [6].The Adaptive Neuro-Fuzzy Inference System (ANFIS) has recently been the center of attraction of researchers in scientific,engineering areas. Intelligent control technique using fuzzy logic control is associated toan MPPT controller in order to increase energy conversion efficiency and now this fuzzy logic controller is improved by using genetic algorithms (GA) [7,8].In this paper, a MPPT technique for solar PV array based on artificial neural networks is presented. Section 2 presents the solar PV cell equivalent circuit. Section 3 presents the PV array characteristics and section 4 presents the Artificial Neural

MECHANICAL ENGINEERING

Multi-objective thermodynamic optimization of an irreversible regenerative Brayton cycle using evolutionary algorithm and decision making

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Abstract Brayton heat engine model is developed in MATLAB simulink environment and thermodynamic optimization based on finite time thermodynamic analysis along with multiple criteria is implemented. The proposed work investigates optimal values of various decision variables that simultaneously optimize power output, thermal efficiency and ecological function using evolutionary algorithm based on NSGA-II. Pareto optimal frontier between triple and dual objectives is obtained and best optimal value is selected using Fuzzy, TOPSIS, LINMAP and Shannon's entropy decision making methods. Triple objective evolutionary approach applied to the proposed model gives power output, thermal efficiency, ecological function as (53.89 kW, 0.1611, −142 kW) which are 29.78%, 25.86% and 21.13% lower in comparison with reversible system. Furthermore, the present study reflects the effect of various heat capacitance rates and component efficiencies on triple objectives in graphical custom. Finally, with the aim of error investigation, average and maximum errors of obtained results are computed.

1. Introduction

Brayton cycles have been broadly used in gas power plants, airplanes, ship propulsion and numerous industrial usages. Intercooler compression, reheater expansion, regeneration and isothermal heat addition are few amendments [1–20] which have been acknowledged theoretically to upgrade the performance of Brayton cycles. In recent years, significant consideration has been given to single objective optimization of Brayton heat engine through range of objective functions

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Performance Optimization of Two-Stage Exoreversible Thermoelectric Converter in Electrically Series and Parallel Configuration

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A two-stage exoreversible semiconductor thermoelectric converter (TEC) with internal heat transfer is proposed in two different configurations, i.e., electrically series and electrically parallel. The TEC performance assuming Newton's heat transfer law is evaluated through a combination of finite-time thermodynamics (FTT) and nonequilibrium thermodynamics. A formulation based on the power output versus working electrical current and efficiency versus working electrical current is applied in this study. For fixed total number of thermoelectric elements, the current–voltage (I–V) characteristics of the series and parallel configurations have been obtained for different combinations of thermoelectric elements in the top and bottom stage. The number of thermoelectric elements in the top stage has been optimized to maximize the power output of the TEC in the electrically series and parallel modes. Thermodynamic models for a multistage TEC system considering internal irreversibilities have been developed in a matrix laboratory Simulink environment. The effect of load resistance on V_{opt}, I_{opt}, V_{oc}, and I_{sc} for different combinations of thermoelectric elements in the top and bottom stage has been analyzed. The I–V characteristics obtained for the two-stage series and parallel TEC configurations suggest a range of load resistance values to be chosen, in turn indicating the suitability of the parallel rather than series configuration when designing real multistage TECs. This analysis will be helpful in designing actual multistage TECs.

Key words: Two-stage semiconductor thermoelectric converter, finite-time thermodynamics, nonequilibrium thermodynamics, optimization

List of symbols

P	Power output of the converter (W)
η	Thermal efficiency of thermoelectric converter
Q	Rate of heat transfer (W)
K	Thermal conductance of the semiconductor couple (W/K)
M	Total number of pairs of thermoelectric elements of thermoelectric converter
n	Pairs of thermoelectric elements of top stage of thermoelectric converter
m	Pairs of thermoelectric elements of bottom stage of thermoelectric converter
R	Total internal electrical resistance of the semiconductor couple (Ω)
I	Working electrical current (A)
T	Temperature (K)
V	Voltage (V)
TEC	Thermoelectric converter

Greek letters

α	Seebeck coefficient (V/K)
Δ	Difference

Subscripts

1	Top stage of thermoelectric converter

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Study of magnetic behavior in ball-milled nanocrystalline Fe-50 at.%Al alloy as a function of milling time

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Ball milling technique has been extensively used to prepare different metastable states with nanocrystalline microstructures from intermetallic compounds. The present study was made on the identification of the changes in magnetic and electronic properties as a result of high-energy ball milling of Fe-50 at.% Al alloy samples. The phase formation and physical properties of the alloys were determined as a function of milling time by means of Mössbauer and X-ray photoelectron spectroscopy (XPS). The Mössbauer results show the formation of nanostructured body-centered cubic (BCC) FeAl alloy only after 5 h of mechanical milling and the same is also confirmed by Scanning electron microscope (SEM) and Transmission electron microscopy (TEM) studies. Mössbauer studies further confirm that there is magnetic behavior retention in the FeAl alloy samples even after 5 h of milling but magnetization decreases as the milling time increases. The reason for the same is due to the shocks and fracturing of the Al atoms embedded in the sites of Fe and as a result of which Fe–Fe nearest neighbors decreases. Secondly, with the increase in milling time, the particle size and the number density of equiatomic BCC $Fe_{50}Al_{50}$ grains decrease while the volume of grain boundary containing a solid solution of BCC FeAl and concentration of Al in a solid solution of BCC FeAl at the grain boundary increases as a result of which magnetization decreases. The shift in the binding energy of Fe_{2p} and Al_{2p} core level towards higher binding energy also supports the alloy formation after milling.

Keywords: Mechanical alloying; phase formation; Mössbauer spectroscopy; XPS.

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Structural and magnetic stability of high energy ball milled Co₂MnSi

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ABSTRACT

Structural and magnetic properties of ball milled Co₂MnSi have been studied and compared with that of ordered bulk sample. The milled sample (with average size determined using the Williamson–Hall method) shows that the chemical ordering for this sample is very stable and is little effected by high energy ball milling. However, the reduction in the saturation magnetic moment of the milled sample shows that there is spin disordering induced on ball milling – attributable to the formation of a magnetically dead layer at the surface of the nano-sized samples. The ordered sample (unmilled) has a saturation moment value of 4.4 µB per formula unit at room temperature and is in agreement with the prediction of Slater Pauling curve. On milling it reduces to ~3 µB per formula unit at room temperature with an accompanying increase in the coercivity, retentivity and squareness factor.

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1. Introduction

Among the Heusler alloy family Co₂MnSi attracted scientific community in last decades due to the existence of band gap in the minority spin sub band which have been proved theoretically and experimentally [1,2]. This material shows half metallicity, highest magnetic moment, highest spin polarization and Curie temperature which are essential requirement for spintronic applications. Half-metallic ferromagnets are systems in which at the Fermi level (ε_F) the density of states of one spin sub band is very small where that of the other is large. Such systems have metallic behavior for electrons of one spin state and insulating behavior for the other. This class of materials opens the way to engineer to prepare alloys with the desired magnetic properties. Bulk ordered Co₂MnSi Heusler alloy [3] and its thin films [4,5] on different substrate have been studied extensively in past years but there is no study reported on nanostructured form. Since the magnetic properties in nano-sized materials are very different and affected by the particle size as well as by the chemical and structural nature of the material. High energy ball milling is a well-established technique that has become popular in recent years for the synthesis of nanostructured intermetallic alloys through solid-state reactions. This method is cost effective and it is suitable for large scale industrial production. Nanoferromagnetic particles play a vital role for the production of high density magnetic recording media as well as nanoscale magnetic driven sensors. The mechanical alloying or mechanical milling process has been widely used to produce alloys, amorphous materials, nanostructured materials and extended solid solutions [6–8]. Ball milling offers mass production of nanocrystalline powders with grain size well in the nano regime [9,10]. However, many factors such as the dynamics of milling media, evolution of microstructure, formation of different metastable and stable phases during the process has still not been well understood since there are many factors that affect the ball milling process. These factors include the number and size of balls, density of ball material, the ball to powder weight ratio and ball to powder volume ratio, the milling temperature, nature of the grinding atmosphere, chemical composition of powder mixtures and of grinding tools [11]. In this paper we report the results of studies on nano-sized Co₂MnSi prepared by high energy ball milling and are compared with that of bulk.

2. Experimental

The bulk sample with stoichiometric composition was prepared by repeated melting in an arc furnace with argon atmosphere. The melted samples were crushed and packed in to quartz ampoules under a vacuum of 5×10^{-5} Torr and annealed for 800 °C for 16 days. Part of the sample was taken and milled for different durations (30,60,90 and 120 min) in a SPEX 8000 M mixer/mill using

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A cultivated differential evolution variant for molecular potential energy problem

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Abstract

Differential Evolution (DE) algorithms are known to as robust, effective and highly efficient for solving the global optimization problems. In the present study, a modified variant of Differential Evolution (DE) is proposed in the present study, named Cultivated Differential Evolution (CuDE) which is different from basic DE in the selection of the base vector for mutation operation and population generation for next generation. The performance of the proposed algorithm is validated on six benchmark problems taken from literature and a real time molecular potential energy problem. The numerical results show that the proposed algorithm helps in formulating a better trade-off between convergence rate and efficiency.

Keywords: Differential Evolution; Donor Mutation; Selection; Information Preservation; Molecular Potential Energy Problem;

1. Introduction

Differential Evolution (DE) is a variant of Evolutionary Algorithm (EA), proposed by Storn and Price [1] in 1995. DE is used for solving global optimization problems over continuous spaces. It is a simple and efficient search engine which can handle nonlinear, non-differentiable and multimodal objective functions and a wide range of real

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Research Article

Effect of Addition of Hydrophobic Hydrocarbons on the Hygroscopic Tendency of Ammonium Nitrate Crystals

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Abstract

The present study is aimed towards the use of selected hydrophobic hydrocarbons to attain a waterproof coating on Ammonium Nitrate crystals. High hygroscopic nature of Ammonium Nitrate makes it impractical for its use as oxidizer in composite solid propellant formulations as absorption of water molecules by Ammonium Nitrate from moisture in the atmosphere negatively affects the structural integrity, energetics and ballistic performance of the Ammonium Nitrate based propellant grains. Hydrocarbons, generally waxes and oils, are hydrophobic in nature and may thus be utilized to repel water molecules resulting in a reduced water absorption by Ammonium Nitrate crystals. In the present study, the effect of addition of Paraffin Wax, Micro-crystalline Wax & Bees Wax along with pure Ammonium Nitrate is observed and compared. Samples were prepared by adding varying and significantly small weight percentages of waxes with Untreated Ammonium Nitrate and were kept under normal laboratory conditions. A weight increment rate study of all the prepared samples were conducted on a daily basis for a period of 20 days. All prepared samples, under same atmospheric conditions, exhibited different water absorption rates which were then compared to reveal the waterproofing capabilities of specific additives.

Keywords: Ammonium Nitrate, Hydrophobic Hydrocarbons, Paraffin Wax, Micro-crystalline Wax, Bees Wax, Waterproofing.

1. Introduction

Ammonium Nitrate (AN), though being an economical and eco-friendly oxidizer, suffers a very limited use in the formulations of composite solid propellant (CSP) grains due to its high hygroscopic nature. The Nitrate salt of Ammonium with chemical formula NH_4NO_3, with appearance of white crystalline solid, is highly soluble in water (Zapp *et al*, 2000). Ammonium Nitrate tends to absorb water molecules from moisture present in the atmosphere which results in liquefaction and/ or a change in state of the compound. Another major drawback of AN is its dimensional instability due to its five phase state transitions ranging from -200 °C to its boiling point, i.e. 125 °C. These phase modifications leads to a decrease in the adherence between the crystallites and result in severe structural changes in the crystal lattice of Ammonium Nitrate (Hendricks *et al*, 1932), (Brown *et al*, 1962). Owing to these inherent shortcomings, structural strength of AN based propellant grains decrease significantly during these thermal cycles and leads to the formation of cracks in the propellant grains.

Such cracks result in an unexpected increase in burning surface area of the propellant (Flack-Muss et al, 1972). At any instant, mass flow rate of hot gases generated and flowing from the motor under stable combustion conditions is governed by the following empirical formula (Sutton *et al*, 2001):

$$\dot{m} = \rho p. Ab. r \tag{1}$$

Where,

$\dot{m}$ = mass flow rate of hot gases generated,
ρp = density of propellant prior to motor start,
Ab = burning area of the propellant grain,
r = propellant burn rate.

Formation of cracks in the propellant grains open up new additional burning surfaces causing an unexpected increase in the generation of mass flow of hot gases as is evident from Equation 1. Such increased mass flow may over pressurize the solid rocket motor (SRM) leading to a disastrous failure of the mission. Hence, any inherent property of an ingredient used in the formulation of CSPs which may lead to occurrence of cracks, should be diminished.

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Science & Education
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Designing of a Standalone Photovoltaic System for a Residential Building in Gurgaon, India

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Abstract Photovoltaic power system, through direct conversion of solar irradiance into electricity, can be used as electrical power source for home to meet its daily energy requirement. In this paper detailed design of a standalone photovoltaic power system for uninterrupted power supply of a residential building in a typical urban area is presented. The process of acquiring photovoltaic power involves designing, selecting and determining specifications of different components that are used in the system conforming the load estimation. Accomplishment of this process depends on a variety of factors, such as geographical location, weather condition, solar irradiance, and load consumption. This paper outlines in detail the procedure for specifying each component of the standalone photovoltaic power system and as a case study, a residence in Gurgaon, India with typical energy consumption is selected. Detailed cost analysis including installation and maintenance of a solar PV system during its life span have been carried out also. The analysis shows though the initial investment is high, still, within few years it not only returns this amount but also gain substantial dividend during the system life span.

Keywords: photovoltaic array, inverter, charge controller, battery, module orientation, payback period

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1. Introduction

Energy plays a fundamental role in our daily activities. The degree of development and civilization of a country is determined by the amount of energy utilized by its human beings. Energy demand is increasing day by day due to increase in population, urbanization and industrialization. The world's fossil fuel supply viz. coal, petroleum and natural gas, main source of energy until now, will thus be exhausted in a few hundred years [1]. On one hand, the rate of energy consumption increasing, on the other hand, fuel supply depleting - it will lead to energy crisis one day. It will also results in inflation, poverty and global warming [2]. Hence alternative or clean renewable energy sources have to be explored and developed to meet future energy requirement. Solar energy, wind energy, etc. are clean, inexhaustible and environment- friendly resources among the renewable energy options.

Utilizing solar energy we can fulfil our daily energy needs during sunshine hours. But neither solar nor wind energy system can provide a continuous supply of energy demand throughout a day, like in the night time or in other conditions when sunshine or wind power is not there or not enough to fulfil the demand. At that off-time extra energy storage devices are required to meet the demand. In this context, standalone solar power systems are now being contemplated.

Different places on the globe experience different climatic conditions. Total solar irradiance that reaches the surface of earth varies with time of day, season, location and weather conditions. Therefore, design of a standalone solar system cannot have only one standard. Location is a major aspect that will affect photovoltaic power system design and it varies from place to place [3]. India is blessed with enough sun shine which can meet our energy demand without any compromise and it is also pollution free. Standalone PV system is a popular concept in rural areas of India where national electricity grid connection facility is not available. But in urban areas where grid connection system is easily available, it is not a common practice to use solar power. There is a general impression that grid energy from conventional sources is much less costly compared to solar and other alternate energy sources.

One of the objective of this paper is to estimate the potential of solar photovoltaic power system in urban areas taking for example, Gurgaon area in the state of Haryana in India. For this purpose, a typical residential building in Haryana is taken up for designing and developing a system based on its daily load requirement. Equipment specifications are provided based on availability of the best components in market. In addition to the design considerations, we have done a detailed cost analysis of the system in this paper. As expected initial cost of solar power plant installation has been found to be very high and so, the cost of solar energy consumption

Analytical Model for Determining the Sun's Position at All Time Zones

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Abstract   Generation of electricity from solar energy using solar photo-voltaic (PV) cell is a promising and growing field. Energy conversion is maximum when the sun is directly overhead and sunrays fall perpendicularly on a solar PV module. Hence, exact position of the sun in sky throughout a day is an important factor to know while designing and installing a solar panel. In this paper, we present an algorithm to determine altitude and azimuth angles that specifies the sun's position at any geographical location precisely. It takes latitude, longitude, date and deference of local time from Greenwich Mean Time as input and logically calculates the angles using Microsoft EXCEL. The location of Gurgaon, India is taken as an example for application of the model to display the sun's path throughout a day in 4 characteristic days in a year and to determine lengths of days from sunrise and sunset times coming also as output. These results can be incorporated in design to orient a solar panel automatically without requiring any cumbersome tracking mechanism.

Keywords Latitude, Longitude, Altitude, Azimuth angle, Hour angle, the Sun and Earth movement, Equation of Time

1. Introduction

The sun is one of the fundamental energy sources in the universe. In the 21st century, ever increasing energy demand may be fulfilled with the help of solar energy that reaches the earth. Efficient and economic harnessing of clean solar power is very crucial for fulfillment of today's growing energy need and also helps stop alarming climatic crisis. Every day the sun radiates an enormous amount of energy. It is the primary energy resource for our plant. The earth receives energy from the sun as electromagnetic radiation at extremely large rate [1]. Daily the amount of energy that strikes each country is more than the energy need of that nation for one and a half year [2].

Photovoltaic (PV) cell is one of the supreme technologies available now to harness solar radiation and generate electricity. Amount of energy generated from a solar module, consisting of numerous PV cells, depends on radiation quality and angle of incidence of sunrays. A solar module can generate maximum electricity when radiation falls vertically on solar panel [3]. However, difficulty in efficient harnessing arises because of ever changing position of the sun continuously with time and location of the module. So, the most challenging task would be how to tilt the solar module at an angle to the horizontal surface throughout the day to fulfill the requirement of a 90° angle between the rays

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of the sun and surface of the solar module.

Parameters like latitude, longitude, season and time of a day at a given location affect the position of the sun and amount of solar energy reaching the earth's surface [4] there. In the tropics (between tropic of cancer and tropic of Capricorn) the sun can be either north or south of the solar module. Whether due south or due north depends on exact latitude of the location. So, depending on the above parameters there is a need to know the sun's position in the sky with respect to a solar PV module.

To position a module directly towards the sun at all times, sometimes a solar tracking system is installed to determine the direction of incoming sunrays. But this is not only complicated but also costly. The most common approach though is to compromise and install the module at an optimum tilt angle so that surface of the module is perpendicular to the direction of radiation at solar noon on the equinox day, i.e. the module tilts at an angle equal to the latitude of that location.

In this paper we present a method that can exactly calculate the sun's position at all time zones, i.e. at any time of a day and at any location in the earth. This knowledge may be incorporated in the design of solar PV and thermal system to orient it automatically without requiring any cumbersome solar tracking mechanism.
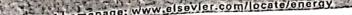
2. Basics of Earth and Sun Movement

At any location on earth the position of the sun in the sky varies with time because of two basic motions of the earth w.r.t. to the sun: a) the earth revolves around the sun

ELSEVIER

Multi-objective and multi-parameter optimization of two-stage thermoelectric generator in electrically series and parallel configurations through NSGA-II

CrossMark

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ABSTRACT

Appropriate consideration of input parameters of a thermoelectric generator (TEG) is essential to design devices with superior performance criteria such as high thermal efficiency and power output. In this view, multi-objective evolutionary algorithm namely non-dominated sorting genetic algorithm-II (NSGA-II) is applied to two-stage exoreversible TEG in electrically series and electrically parallel configurations in matrix laboratory (MATLAB) simulink environment. Simultaneous optimization of proposed system for maximizing power output (P), thermal efficiency (η) and ecological function (E) is done with considering working electric current(I), number of thermoelectric elements in top 'n' and bottom stage 'm', temperature of hot side T_h and cold side T_c as design variables. The present work explores various optimal values of performance parameters/design variables from Pareto frontier of triple and dual objective functions and by using three decision making techniques viz. fuzzy, Shannon and TOPSIS, best solution is selected. With the current study, it has been demonstrated that multi-objective optimization gives much lower difference between ideal and obtained solution, termed as deviation index, as compared to the dual/single objective optimization. The optimal design of TEG achieved by multi-objective optimization formulates an appropriate balance between power, efficiency and ecological function, in order that all the three are improved concurrently.

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1. Introduction

Seebeck effect based semiconductor TEGs (Thermoelectric generators) converts thermal energy into electrical output and offers various advantages over conventional power generators. It has no moving parts or working fluids which make it reliable, rugged and applicable in number of fields with exceptional potential output and its operation with no emission of harmful gases makes it a popular eco-friendly device for power generation [1–3]. Due to continuous thermal cycling the thermoelectric modules (TEMs) can experience performance reduction and mechanical failure due to which figure of merit can reduce up to 4–5% in approximately 45000 thermal cycles [4]. Chen [5] suggested design of autonomous and distributed sensor nodes to implement wireless thermoelectric

module (TEM) management to formulate defective TEMs for series and parallel connected arrays. Extensive research is being carried out for improvement in the physical properties of thermoelectric materials and manufacturing techniques of thermoelectric modules [6,7]. In addition to this, system analysis is essential to design devices with superior performance criteria such as high thermal efficiency and power output. For the performance analysis of single stage or multi-stage TEGs, non-equilibrium thermodynamics is generally used [8,9]. Finite time thermodynamics or entropy generation minimization [10] is a strong tool for performance analysis and optimization of practical thermodynamics processes and devices. Analysis and performance optimization of TEG is done in Ref. [11]. Chen et al. [12] proposed numerical simulation examples based on a coupled analytical thermal model and set of performance formulae; the relationship of figure of merit Z, material property and heat loss with performance for TEGs. A comparative analysis of two-stage and single stage TEG is done by Xiuxiu et al. [13] and found that performance of two-stage TEG is better when

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Fuzzy bi-criteria problem of clustering ration shops to warehouse sites

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Abstract: The bicriteria problem of clustering ration shops to warehouse sites, discussed by Praveena, Prakash and Prasad [16], of minimizing cost and subsequently time is revisited and solved by a new simple time minimization heuristic algorithm. A fuzzy version of the problem is also considered using trapezoidal asymmetric fuzzy numbers for cost and time and the new time minimization heuristic algorithm is applied. Three different ranking function approaches for the trapezoidal fuzzy numbers have been considered and the results compared with the original crisp problem.

Keywords: trapezoidal fuzzy numbers; heuristic; ranking function; bicriteria problem.

I. Introduction

An assignment problem seeks to assign jobs to workers in order to optimize the cost or time or profit. Ignizio and Cavalier [5] have considered the assignment problem of allocating customers to warehouses with the single objective to minimize the total distance traversed by each customer to reach his/her respective warehouse site. Aggarwal, Tikekar and Hsu [1] and Aneja and Punnen [2] have found optimal solutions of the time minimizing assignment problem also called the bottleneck problem.

Bicriteria Assignment problems have been of considerable interest in real life optimization. Geeta and Vartak [4] have solved the bicriteria assignment problem of minimizing cost and time by considering time as two dimensional (workers X jobs) and three dimensional (workers X jobs X machines). Praveena, Prakash and Prasad [16] have solved a special bicriteria problem by an iterative heuristic procedure whereas Prakash, Sharma and Singh [15] have developed a heuristic technique incorporating Tabu search to solve the bicriteria problem.

In real life situations since quantities such as cost, time and profit may be imprecise so the assignment problem extends to fuzzy assignment problem wherein fuzzy quantities are to be optimized . Many researchers have solved the fuzzy assignment problem. Singh and Thakur [18], Kagade and Narkhede [7], Kalairasi, Sindhu and Arunadevi [8], Jahirhussain and Jayaraman [6] and Nagarajan and Solairaju [14] have applied Robust's ranking technique to reduce the fuzzy assignment problem to crisp assignment problem before solving it. They have considered single objective problems with assignment costs being triangular and trapezoidal fuzzy numbers. Roy and Rathore [17] have used the zero suffix method to solve the fuzzy assignment problem. Thorani and Shankar [19] have considered the fuzzy costs as generalized trapezoidal fuzzy numbers whereas Kumar and Gupta [10] have considered the assignment costs as LR fuzzy numbers. Gani and Mohamed [3] have taken the assignment costs as both triangular and trapezoidal fuzzy numbers. They have applied a new ranking technique to convert the problem to LPP form and have solved it using LINGO 9.0. Mukherjee and Basu [13] have applied Yager's ranking method to solve the fuzzy assignment problem. Majumdar and Bhunia [12] have applied genetic algorithm to solve the fuzzy assignment problem. Lin and Wen [11] have simplified the problem to a linear fractional programming problem and then solved it.

In this paper a bicriteria assignment problem of clustering ration shops to warehouse sites has been considered. The two objectives are to minimize the cost and time of meeting all the requirements of the ration shop from its assigned warehouse. Among the potential warehouse sites, warehouses have to be set-up keeping in mind the budgetary restrictions. Also each ration shop can be assigned only to one warehouse whereas a warehouse can cater to more than one ration shop. In medical and warlike situations time minimization is the first priority objective. Motivated by this objective a heuristic time minimizing algorithm is developed and the results compared to those of Praveena, Prakash and Prasad[16]. It is observed that the optimal solution obtained in a single iteration is the same as obtained by the add and drop method developed by Praveena, Prakash and Prasad[16] in three iterations.
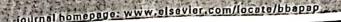
In order to introduce real life impreciseness in the above problem, it has been reformulated with fuzzy cost and fuzzy time and solved using the new heuristic algorithm giving the fuzzy solution.
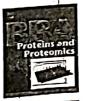
Section II reviews preliminary definitions and notations. In Section III the mathematical formulation of the problem is given and the new heuristic algorithm is proposed. In section IV the numerical example considered by Praveena, Prakash and Prasad[16] is considered and solved by the algorithm discussed in Section III. Section V

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A conserved tryptophan (W91) at the barrel-lid junction modulates the packing and stability of Kunitz (STI) family of inhibitors

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ABSTRACT

β-trefoil fold, consisting of a six stranded β-barrel capped at one end by a lid comprising of another six β-strands, is one of the most important folds among proteins. Important classes of proteins like Interleukins (ILs), Fibroblast Growth Factors (FGFs), Kunitz (STI) family of inhibitors etc. belong to this fold. Their core is packed by hydrophobic residues contributed by the 6 stranded β-barrel and three β-hairpins that make essential contacts with each other and keep the protein in 'topologically minimal frustrated state'. A complete database analysis of the core residues of the β-trefoil fold proteins presented here identified a conserved tryptophan (W91) residue in the Kunitz (STI) family of inhibitors that projects from the lid and interacts with the bottom layer residues of the barrel. This kind of interactions is unique in Kunitz (STI) family because no other families of β-trefoil fold have such a shear sized residue at the barrel lid junction, suggesting its possible importance in packing and stability. We took WCI as a representative of this family and prepared four cavity creating mutants W91F-WCI, W91M-WCI, W91I-WCI & W91A-WCI. CD experiments show that the secondary structure of the mutants remains indistinguishable with the wild type. Crystal structures of the mutants W91F-WCI, W91M-WCI & W91A-WCI also show the same feature. However, slight readjustments of the side chains around the site of mutation have been observed so as to minimize the cavity created due to mutation. Comparative stability of these mutants, estimated using heat denaturation CD spectroscopy, indicates that stability of the mutants inversely correlates with the size of the cavity inside the core. Interestingly, although we mutated at the core, mutants show varying susceptibility against tryptic digestion that grossly follow their instability determined by CD. Our findings suggest that the W91 residue plays an important role in determining the stability and packing of the core of WCI.

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1. Introduction

Structural studies with globular proteins have identified an enormous number of uniquely different proteins that are classified under one of the ten fundamental folds [1]. The majority of these superfolds contain a highly symmetric tertiary structure; postulated to evolve via gene duplication and fusion events [2]. β-trefoil fold represents a distinct and important class of superfold consisting of proteins having a wide spectrum of functionalities, which include human fibroblast growth factors, interleukins-1, clostridium neurotoxins, mannose receptors, Kunitz (STI) protease inhibitors, etc. [3–6]. A detailed study of the geometry and architecture of the β-trefoil fold was done by Chothia and his co-workers [7] indicating that they have an all-β

structure with structural architecture comprising of three repeating units (Supplementary Fig. 1). Each repeating unit is made up of four β strands with connecting loops of varying size that stack together to form a six stranded β-barrel and a lid composed of three β-hairpins that cap one hollow end of the barrel (Supplementary Fig. 1) [7]. Despite the retention of symmetric tertiary structure, the proteins of β-trefoil family have diverged considerably in terms of their primary sequence [8]. The presence of a pseudo three-fold symmetry suggests that this fold has arisen from the triplication and evolution of gene from one trefoil [9]. Feng et al. have shown that proteins belonging to β-trefoil fold have certain conserved residues which are distributed symmetrically in the structure and explained how these symmetric structures have emerged from apparently asymmetric sequences [10], which is important to understand the evolution and folding pathway of these beta-trefoil fold proteins.

The packing of the core of the β-trefoil fold proteins drew considerable attention in terms of their stability and folding. The 'core' of the barrel is packed by 15–18 hydrophobic residues, contributed by the six stranded β-barrel and three β-hairpins, which make essential contacts with each other and keep the protein in 'topologically minimal frustrated state' [11]. Packing of these hydrophobic residues leaves

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Mechanically induced phase transformation and magnetic properties of nanocrystalline Fe-50%Al alloy

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Evolution of magnetic order in nanocrystalline Fe-50%Al alloy during ball milling of elemental powders

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FraaS: A Framework for Digital Forensic Services in a Cloud-based Environment

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Abstract: Digital forensics is the application of computer science to cater to legal needs. Quality digital forensic services are often encountered by various availability issues. The invention of cloud based services has now enabled researchers to build software or platform level based service channels. In this paper, a multi-tenant capacity framework where digital investigation can be provided as a service in the cloud has been proposed. One can use this service to perform forensic analysis on digital evidence. Services can be procured vide the forensic tools provided on a pay-per-use basis. This paper also suggests a proto-architecture of the proposed Forensics-as-a-Service framework along with its implementation module using SDNs. The architecture of FraaS is built around the NIST guidelines for the same.

Key-words: FraaS (Forensic-as-a-Service), NFAT (Network Forensic Analysis Tool), Digital Forensics, Cloud Services, SaaS, PaaS, SDN (Software Defined Networks), OpenContrail, OpenStack, API (Application Program Interface)

1. Introduction

With the increased dependence on technology in the twenty first century, digital crimes have also paced up. Today almost all of the electronic devices are vulnerable in one way or another.

Digital Forensics can be classified in different segments such as computer forensics, mobile forensics, network/cyber forensics, plastic & smart card forensics, etc. The scope of this paper concentrates specifically on two segments, i.e. computer forensics and network forensics. The other segments of the digital forensics classifications can be implemented similarly. To understand the model of forensic as a service in the cloud, the recommendations of National Institute of Standards and Technology (NIST) have been considered. The digital forensics procedures involve four major processes namely Collection, Examination, Analysis and Reporting [1]. The proposed Forensics-as-a-Service (FraaS) also provides services based on these basic recommendations where specific applications are designed for collection of data from the actual evidence, the proper examination of integrity and authenticity of the data which further eases the output to analyze as per requirement. The storage database than allows the researchers and analysts to use the reporting module to

ORIGINAL PAPER

Dopant Segregation and Heat Treatment Effects on the Electrical Properties of Polycrystalline Silicon thin Films

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Abstract This paper reports the effect of heat treatment on the electronic activity of grain boundaries of polycrystalline silicon. The results obtained show that for the same concentration of doping, the arsenic doped films are more resistive and have less free carriers than boron doped films. The arsenic atoms have a greater tendency to segregate at the grain boundaries than boron atoms. We also noticed that the heat treatment before implantation reduces the number of trap carriers and the quantity of doping atoms at the grain boundaries. For low doping, the concentration of the free charge carriers improves after the heat treatment by 100 % and 23 % for arsenic and boron doping respectively.

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1 Introduction

The solar cells manufactured based on polycrystalline silicon are affected by the presence of grain boundaries. The grain boundaries form electrical shunts and increase the series resistance; they thus decrease the photovoltaic performance of these devices. The efficiency of the materials requires improvement and control of properties [1–8]. The low photovoltaic conversion efficiency obtained with solar cells made of polycrystalline silicon is mainly due to the electronic activity of grain boundaries. The high density of recombination centers at the grain boundaries causes attenuation of the collecting minority carriers. Use of polycrystalline silicon for the solar cells brings down their cost and at the same time the photovoltaic conversion efficiency is reduced. In many applications, polycrystalline silicon is subject to various heat treatments that aim to reduce defects and allow ions implanted to take positions where they are electrically active [9]. Apart from applications in solar cells, the polycrystalline silicon thin films have been used in many other areas such as thin film transistors [10], MOSFET's [11] integrated circuits [12] and optoelectronic devices [13].

2 Experimental

Polycrystalline silicon thin films were deposited by standard low pressure chemical vapor deposition LPCVD at 620 °C by silane (SiH₄) decomposition. Thin films of the thickness of the order of 0.7 μm thickness were deposited on a mono-crystalline silicon substrate of orientation <111>