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Solar energy capacity assessment and performance evaluation of a standalone PV system using PVSYST

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ABSTRACT

In today's time, photovoltaic systems are continuously gaining popularity and emerging due to their high sustainability, autonomy, and viability. It is necessary to assess the performance of these systems to understand various aspects related to their operation. The study analyses the usefulness of a PV system installation that supplies electricity to an academic institution. This paper aims to evaluate the performance of a grid-connected silicon-poly PV system with a peak power of 20.0 kW and voltage of 17v. The software used for analysis is PVsyst (7.1.7 version). PVsyst is a widely used simulation software for estimating the energy yield and for optimizing the system design. The PVsyst software has been used to design a grid-connected PV system for the Karunya Institute of technology. The simulated system has silicon-poly PV modules assembled in it. Each module consists of numerous photovoltaic cells interconnected. Each module has a power rating of 180wP and voltage sizing of Vmpp (60-degree Celsius) 17.5v Voc (−10degree) 28.9v. The photovoltaic modules are assembled in a total of 13 strings. Modules in a string are series-connected. Each string in the system consists of 10 PV modules connected in series with a power rating of 20.8 kW. The arrangement is grid-connected with a utility meter. The weather dataset used for evaluation is extracted from PVsyst's database and has the attributes, solar radiation, and ambient temperature.

Selection and peer-review under responsibility of the scientific committee of the International Conference on Nanoelectronics, Nanophotonics, Nanomaterials, Nanobioscience & Nanotechnology.

1. Introduction

The use of photovoltaic systems for electricity generation is becoming very prominent in recent times. This rise is mainly due to a shortage of other energy resources, e.g., fossil fuels. So there is a need to switch to reliable and sustainable resources such as photovoltaic systems. It taps the inexhaustible energy from sunlight and converts it into electrical energy [1–3]. It is cost-effective as it has only purchase and installation costs. PV systems are eco-friendly as it does not emit any hazardous gases. Hike in fuel prices is also one of the reasons for PV systems to gain popularity. Since India is a tropical country, it tends to be warm throughout the year and has solar energy in abundance. So, usage of solar panels has widened in countries like India. The government has also promoted the use of PV systems by offering incentives and exemptions from the tax [4,5]. In addition to these pros, PV systems also have certain demerits. The efficiency of a PV system is mainly based on the climatic conditions of a particular place. Not all counties around the globe have hot climates. So, the installation of solar panels in these regions might be impractical. Also, the cyclic variations of the seasons are a prime factor that has to be considered. The overall efficiency of a PV system is influenced by various factors such as the material of the photovoltaic cell, installation method, inclination or orientation of the system, arrangement

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Recent advances on nano-adsorbents and nanomembranes for the remediation of water

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ABSTRACT

Water is the most essential thing to life on earth but in water scarce regions of the world do not have easy access to clean water for their daily needs. One of the major causes of clean water accessibility to all is the contamination of various pollutants in water bodies. The common water pollutants are inorganic heavy metal ions, organic impurities, and microorganisms. To overcome this problem, a large number of water remediation techniques have been in use since ancient times. In the last four decades, there are breakthrough developments in the methods for water purification and the most important one is the use of nanoscale materials. The application of engineered nanoparticles and nanomembranes are the most recent ones. This review article has incorporated the recent advances in water purification methods using engineered nanoparticles and nanomembranes. The risk associated with use of nanoscale materials and the future aspects have also been highlighted in the article.

1. Introduction

'Water', the most essential entity on the earth on which the survival of all kinds of living systems is based. Despite of the presence of 70% water on earth surface; only 1% is accessible for drinking purpose. The increasing levels of pollution due to heavy industrialization, population explosion, development in agricultural sectors and urbanization have caused scarcity of pure water. The rapid development has resulted into contamination of groundwater, drinking and surface water by various toxic materials including radioactive nuclides, hazardous chemicals, heavy metal ions, pathogens, pesticides, and other harmful microorganism (Zhang et al., 2019a; Babic et al., 2017; Hai et al., 2014; Chen et al., 2019) that can create serious diseases which are threatening for human health and environment as well. According to the WHO latest report, around 2 billion people are using contaminated drinking water source with faeces which can cause estimated 485,000 diarrheal global deaths every year (WHO, 2017). It has become one of the major challenges for mankind to make proper arrangements of pure drinking water. Hence, the urge for the development of innovative technologies has become a necessity for wastewater treatment.

Multiple conventional water remediation techniques are already available to address this problem but the advancement is required due to the lack of efficacy for appropriate pollutants removal with negligible wastage. Traditional filtration methods are also in process; these methods are good in removing contaminants however, they are quite insufficient and also increase toxicants which are difficult to dispose properly. The high-power requirement in running traditional techniques is also one of the reasons that force us to think some advanced methods for water remediation.

In recent years, nanotechnology has showed remarkable advancement in various emerging fields of active research and development such as bioanalytical sciences (Kecili et al., 2019; Rajesh et al., 2021), agriculture industry (Acharya and Pal, 2020), food industry (Palit, 2020), water remediation (Ahmad et al., 2019; Gehrke et al., 2015) to list a few. The advancement in technologies turn up the utilization of nanoscale materials in resolving the water remediation issues due to their incredible physicochemical properties *viz.* large surface to volume ratio, easier functionalization ability to enhance affinity and selectivity, and high sorbent capabilities (Li et al., 2016; Zhang et al., 2019b). Nanoscale materials are those materials which have minimum one dimension with size in the range of 1–100 nm such as nanofilms, nanowires, nanotubes, colloids, and quantum dots (Kargozar and Mozafari, 2018). At this minute level, materials exhibit a very high surface to volume ratio resulting into exceptional absorbance ability as well as high reactivity,

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Insights to improve the tribo-performance of materials used under slurry erosion applications: A review

Yogesh Kumar Yadav , Akant Kumar Singh , and Siddhartha View all authors and affiliations
Volume 237, Issue 1
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Abstract

Slurry erosion usually results in the form of damage to the materials of different components having underwater working domain. Numerous industries have suffered due to this kind of wear resulting in frequent breakdowns demanding repeated financial assistance and poor productivity. Properties and tribo-performance of materials related to distinct slurry applications play a significant role in arresting the slurry erosion wear. Slurry erosion depends on different parameters such as impact velocity, impingement angle, shape and size of erodent, slurry concentration and so on. These parameters differ from one application to another and accordingly, specific materials are selected knowing the extent and severity of slurry erosion wear. In the last decade, many authors studied parametrically the tribo-slurry erosion performance of materials, few of them correlated their investigations to the actual in situ conditions of applications. Various authors have analyzed the effect of operating parameters on the mechanism of erosion and conducted the comparative studies of different materials. Many of the investigators attempted to improve the properties and tribo-slurry erosion performance of materials through surface modification techniques; coating, reinforcement, heat treatment, thermo-mechanical process etc. This review is an effort to covers all such kind of explorations.

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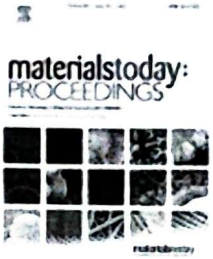

Investigations on noise emission from functionally graded materials based polymer spur gears

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Abstract

There is tremendous growth in the polymer gearing field. Polymer gears have replaced the metal gears in various fields. Polymer gears are now used for low, medium, and even for high power transmission systems, especially in automotive engineering. Noise emission from polymer gears is much less than metal gears in an application. In the present work, homogeneous and functionally graded materials (FGMs) gears are fabricated by glass fiber reinforced high-density polyethylene (HDPE) material via traditional and centrifugal casting techniques, respectively. Gears are manufactured by HDPE granules reinforced with fifteen weight percent and thirty weight percent of glass fibers. The focus of this experimental study is to examine the noise generation from the fabricated gears during the operation. Fabricated gears are run for 2 lakh cycles at different

speeds and torque. The value of torque and speed are chosen within the range of 0.8–2.6 Nm and 500–1400 rpm, respectively. Experiments are performed on the polymer gear test rig. Noise emission from fabricated polymer gears is investigated for various running combinations of torque and speed.

Introduction

Plastic gears have some key advantages over metal gear in weight, coefficient of friction, cost, and noise generation. Plastic gears are now an effective alternative to metal gears in various applications. Plastic gears are useful in improving the efficiency and design of the system in some power transmission applications [1]. Acoustic is distinct as a feature characterized by non-musical sounds. Gears used in gear trains produce chatter, which is a noise source. Currently, noise management in a gear train running at high speed is the main challenge for the plastic gear manufacturer [2]. Gear material resilience, operation environment, contact ratio, transmission error, and quality of gears are the main factors for the acoustic emission in a gear-based transmission system [3].

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Investigation of solid particle erosion behavior of Al-Al_2O_3 and Al-ZrO_2 metal matrix composites fabricated through powder metallurgy technique

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Manvendra Yadav [a b], L.A. Kumaraswamidhas [b], Sudhir Kumar Singh [c]

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Abstract

The proposed research article presents an experimental investigation of solid particle erosion wear of Al_2O_3 and ZrO_2 ceramic oxide reinforced metal matrix composite developed via powder metallurgy method. Two different kinds of metal matrix composites, Al-Al_2O_3 and Al-ZrO_2 were developed with different proportions (0, 2.5, 5 and 10 wt%) of micro-sized ceramic oxide reinforcement powders. Vickers Hardness (HV), experimental densities of sintered samples, XRD and EDS were evaluated for mechanical characterization of fabricated metal matrix composites. Solid particle erosion wear tests were carried out at impingement angles 30–90° at varying set impact velocities of 30–90 m/s on air-jet erosion wear test rig using tiny micro-sized Al_2O_3 powders as an erodent. Air–jet erosion experiments were conducted as per the G76 standard for study of the steady-state erosion wear. ANOVA test revealed that wt% of reinforced contents was a significant parameter followed by impact velocity. 5 wt% of ZrO_2 was observed to be the best wt% of reinforcement of all the combination of fabricated composites.

Hindawi

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A Liver Damage Prediction Using Partial Differential Segmentation with Improved Convolutional Neural Network

B. Sumathy,[1] Pankaj Dadheech ,[2] Monika Jain,[3] Ankur Saxena ,[4] S. Hemalatha,[5] Wenqi Liu,[6] and **Stephen Jeswinde Nuagah** [7]

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Abstract

Background. The liver is one of the most significant and most essential organs in the human body. It is divided into two granular lobes, one on the right and one on the left, connected by a bile duct. The liver is essential in the removal of waste products from human food consumption, the creation of bile, the regulation of metabolic activities, the cleaning of the blood by sensitizing digestive management, and the storage of vitamins and minerals. To perform the classification of liver illnesses using computed tomography (CT scans), two critical phases must first be completed: liver segmentation and categorization. The most difficult challenge in categorizing liver disease is distinguishing the liver from the other organs near it. *Methodology.* Liver biopsy is a kind of invasive diagnostic procedure, widely regarded as the gold standard for accurately estimating the severity of liver disease. Noninvasive approaches for examining liver illnesses, such as blood serum markers and medical imaging (ultrasound, magnetic resonance MR, and CT) have also been developed. This approach uses the Partial Differential Technique (PDT) to separate the liver from the other

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Abstract

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Full Length Article

An IEEE single-precision arithmetic based beamformer architecture for phased array ultrasound imaging system☆,☆☆

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Mayur Agarwal [a], Abhishek Tomar [a], Navneet Kumar [b]

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Abstract

Ultrasound imaging is a largely used medical imaging system as it is safe, non-invasive, and capable of real-time imaging. In ultrasound imaging, different beamforming methods are used to obtain the image of the field of view. The image quality largely depends on the type of beamforming used in ultrasound imaging. To make the ultrasound imaging system portable, beamforming system needs to be implemented as compact hardware architecture. Dynamic focusing and adaptive apodization are used in beamforming systems to generate high-quality ultrasound images, however, their implementation into the hardware requires large hardware resource which consumes high power. This paper presents the implementation of a compact receive beamformer architecture using a hardware-efficient dynamic delay calculator, an IEEE single-precision arithmetic based adaptive apodization system architecture and a focusing mechanism. The proposed beamformer provides real-time beamforming output which can be used to display high quality ultrasound images. Field-II toolbox is used to simulate and verify the beamformer output. The proposed beamformer consumes 1370*k* NAND-2 gate equivalent logic resources in UMC 90 *nm* CMOS standard cell library.

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