

Parameter Improved Particle Swarm Optimization Based Direct-Current Vector Control Strategy for Solar PV System

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Abstract—This paper projects Parameter Improved Particle Swarm Optimization (PIPSO) based direct current vector control technology for the integration of photovoltaic array in an AC micro-grid to enhance the system performance and stability. A photovoltaic system incorporated with AC micro-grid is taken as the pursuit of research study. The test system features two power converters namely, PV side converter which consists of DC-DC boost converter with Perturbation and Observe (P&O) MPPT control to reap most extreme power from the PV array, and grid side converter which consists of Grid Side-Voltage Source Converter (GS-VSC) with proposed direct current vector control strategy. The gain of the proposed controller is chosen from a set of three values obtained using apriori test and tuned through the PIPSO algorithm so that the Integral of Time multiplied Absolute Error (ITAE) between the actual and the desired DC link capacitor voltage reaches a minimum and allows the system to extract maximum power from PV system, whereas the existing d-q control strategy is found to perform slowly to control the DC link voltage under varying solar insolation and load fluctuations. From simulation results, it is evident that the proposed optimal control technique provides robust control and improved efficiency.

Index Terms—solar energy, particle swarm optimization, optimal control, power conditioning, microgrids.

I. INTRODUCTION

Since fossil fuel power generation system has major disadvantages and environmental pollution, renewable energy sources is an admirable alternative solution for fossil fuel exhaustion. Nowadays, renewable power sources such as solar cells, hydrogen-fuel cells and wind energy conversion systems are used in power electronics interface [1] as essential elements for grid integration.

During the availability of sunlight, boost DC/DC converter and the Grid-Side Voltage Source Converter (GS-VSC) can transform solar energy to local load and utility grid. However, in the absence of sunlight, the power required for local loads is consumed directly from the main AC grid. Since GS-VSC has been located widely at the feeder tail end, reactive power compensation becomes more operative for load-side consumer voltage support. In grid-connected condition, the commercial inverters mainly inject active power only to the grid [2-3].

On the other hand, it is possible to integrate power quality

functions by compensating the reactive power of the local loads. The reactive power capacity of the voltage source inverter is limited by the current-carrying capability of the Insulated Gate Bipolar Transistor (IGBT) and dc-link voltage. In the meantime, solar photo voltaic output power is at all times less than the inverter rated power and its remaining capacity can be used for the reactive power supply [4-5].

The reactive power, voltage control and harmonics current compensation methods are conferred for distribution generation systems in [6-7]. The grid connected power quality compensator with distribution generation can control not only the active power flow, but also can alleviate load unbalance, harmonics, and manage reactive power by using Instantaneous Reactive Power (IRP) theory and the Synchronous Reference Frame (SRF) theory. These theories are mostly addressed in the literature [8].

The performance of a GS-VSC in AC micro-grid depends not just on type of converter topologies but also on how the converter has been controlled. Conventionally, controlling of a GS-VSC in AC micro-grid as well as the converter in STATCOM employs the traditional decoupled d-q vector control scheme [9-10]. The performance of the controller has not been discussed in detail, when the converter works below and above the linear modulation limit [11-12]. The origin of this work shows that there are some limitations in the d-q vector control strategy, and the output seems to be large oscillations in the GS-VSC grid connected systems, specifically when the converter works above its linear modulation margin. This paper proposes an optimal PIPSO based tuning for the PI controllers in the direct current vector control approach for a GS-VSC. The purpose of the proposed control technique is to maintain a constant dc capacitor voltage in order to improve the system efficiency and to enhance the system stability both within and beyond the converter linear modulation limit. It compared with the results obtained from the conventional tuning of the PI controller.

The rest of the paper has been organized as follows: the configuration and different operating modes of a test system are focused in Section 2. Section 3 proposes an optimal control philosophy. Section 4 presents simulation study and the system performance comparison. Finally, the Section 5 is concluded with the summary of the main points.

Cost Effective Solitary Stage Single Phase Inverter for Solar PV Integration in to Grid

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Abstract- The ambitious plan exhibited in this paper is to develop a single-phase DC/AC grid-integrated, transformerless and cost-effective inverter for solar Photovoltaic (PV) systems. The costly combination of the two converters specifically DC/DC and DC/AC had inspired the development of this new financially cost effective inverter. This novel solitary stage converter has the capability to operate on both buck mode and buck-boost mode to harvest maximum power from two distinctive PV panels with the help of PI and hysteresis controller. The working principle and configuration of the proposed system are verified under equally, as well as incompatible climatological conditions and hence the system can endure a extensive deviation of voltage in both the PV panels. This inverter requires just four switches and is also free from the shoot-through problem. Owing to noticeable features such as dual MPP tracking, omission of transformer, exclusion of diodes, reduced switch count, negligible losses and wide operating voltage, these PV grid-tie inverters continue to work even during periods of partial shading due to clouds or dust. In addition, the viability of the inverter has been validated both by detailed simulation and exhaustive experimental studies on a 230V/50Hz/2000W research centre model.

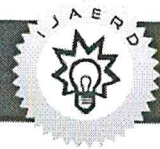
Keywords- Grid integration, Harmonics, Renewable Energy, Solar Photovoltaic, Transformerless Inverter.

1. Introduction

With the increasing shortage of coal and petroleum products and growing demand, power generation will stand out as huge challenge for the government and the energy industry in the future. In such a situation, the government may present a proposal that all houses to be installed with PV panels and should produce power for their own purpose, and also, surplus energy can be exported to the grid. Focusing on the high probability of such a situation, this work was begun. Grid-interactive solar PV systems are gradually becoming a more feasible substitute for electricity generation due to technology improvement and drop in component prices in comparison with the escalating cost of fossil fuels. In this paper, an innovative tactic to enhance the energy generated from the PV panels is proposed using novel DC/AC grid tied inverter.

The AC voltage according to the Indian standard is 230V in the distribution grid. Therefore, the DC voltage generated from the PV modules cannot be connected directly to the grid, but must be connected through an inverter. Generally, DC/DC converters are utilized to interface the PV panel, keeping in mind the need to harvest the most energy and DC/AC inverters are utilized for connecting through the grid to inject a sinusoidal current into the grid. In this work, the DC/DC converter is eliminated. Tolerance for an extremely wide range of input voltage variations of the proposed grid-tie inverter is ready to influence the solar power system when run even on cloudy days or during early mornings and late afternoons. Minding the above-mentioned needs, the literature survey was begun on various types of grid-tied inverters suitable for PV applications.

The rapid fashion and increased significance of sustainable power source using solar PV are essential in



3 Comparative study on double slope solar still using different absorber basin tray materials

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Keywords: solar still; absorber basin; performance; distillate production; efficiency

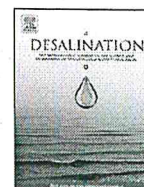
ABSTRACT

Increase in population and depletion of water resources by livelihood and exploitation for industrial and other process requirements necessitates purification and recycling of contaminated water as a conservative measure apart from desalination. Solar still is a simple device used for converting water from such sources into pure one. The performance and distillate production of a solar still is influenced significantly by various parameters like intensity of solar radiation, temperature difference between surface water and glass cover plate, collector area, water depth, glass thickness and insulation. In this research, various absorber basin trays made up of Copper, Aluminium, Stainless Steel and Glass Fibre Reinforced Plastic (GFRP) have been used in the double slope solar still. This experimental analysis has been carried out to harness the maximum solar energy in order to yield higher distillate output. Solar still with Copper basin tray exhibited a better performance than the others. The results of solar still with GFRP basin tray is comparable to that of the others and thus shall be employed by modifying and improving the design of solar still by



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Engineering Advance

Factors influencing the performance and productivity of solar stills - A review

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ABSTRACT

Water scarcity is a major threat for future as the fresh water resources are being exploited and polluted rapidly by mankind. Hence, converting the brackish, saline water in to pure water is one of the viable solutions to overcome the demand for water. Desalination using solar still is simple among various techniques available for removal of salinity. The limitation being its productivity, researchers have consistently attempted to improve the performance of solar stills. This article reviews various factors that influence the performance of the solar still like solar radiation intensity, temperature difference, collector area, basin water depth, insulation, angle of inclination, thickness of glass cover plate, wind velocity and a few methods for improving the quantity of distillate produced. Such a review would benefit the knowledge society for further research and development of a solar still to make it an economically viable option.

1. Introduction

Water is an elixir of life. Water covers approximately three fourth of Earth's surface. About 97% is salty seawater and 2% is frozen in glaciers and polar ice caps. Thus, the remaining 1% of the world's water supply is a precious commodity which is necessary for our survival [1]. The shortage of clean water for livelihood in many parts of the world is an important problem and requires immediate attention. The demand of fresh water is becoming an increasingly important issue across the world. In arid regions, potable water is very scarce and the establishment of a human habitat in these areas strongly depends on how such water can be made available. The importance of supplying potable water can hardly be over stressed [2]. Solar water desalination is one of the processes that can be used for purification of saline water.

Solar still is the simplest solar desalination device. The solar stills may have single slope or double slope as shown in Figs. 1 and 2. The solar still at its lower part consists of basin which is insulated with insulating material to reduce the thermal losses to the surroundings. The basin consists of absorber plate, coated with black paint to maximize absorption of the incident solar radiation on the basin. An inlet is provided to feed the saline water to the basin. Transparent condensing covers are located on the top of the still. An outlet is provided to collect the distilled water from the gutter or collection channel.

The productivity of the conventional solar still is very low. Thus to augment the productivity of the solar still, several research works are

being carried out [3]. The performance and productivity depends upon many parameters like solar radiation intensity, temperature difference between the cover plate and water, collector or absorber plate area, depth of water, insulation, angle of inclination, thickness of cover plate, and wind velocity. In order to enhance the performance and productivity, solar still can be further improved.

The solar stills are broadly classified into two types namely, active and passive solar stills. Passive solar stills evaporate the basin water directly through sun and active solar still uses some external setup like solar collectors to feed an extra thermal energy for faster evaporation. Design modifications of passive solar stills include wick type stills, spherical solar still, etc. Active solar still includes solar still integrated with solar heater, solar still integrated with solar concentrators, waste heat recovery or pre-heated water active solar still, regenerative active solar still and solar still with heat exchanger.

A floating wick type solar still was designed by Janarathanan [4] and he has shown an increase in productivity of 16% to 50% when compared with conventional solar still.

A spherical type solar still was experimented by Dhiman [5]. In this solar still, a blackened metallic plate was horizontally placed in the center and it is covered by spherical glass cover. The experimental results have shown 30% increase in efficiency when compared to that of the conventional solar still.

Badran had done an experiment using double slope solar still coupled with feed tank, constant head tank and a flat plate collector (FPC).

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RESEARCH ARTICLE

5

Machine learning approach for secure communication in wireless video sensor networks against denial-of-service attacks

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Summary

Mobile ad hoc networks (MANETs) own a flexible framework with the absence of a server, where conventional security components fail to compensate the level of MANET security conditions since it is confined to a particular environment, its data transfer potential, and battery and memory constrains. MANET provides a well-grounded path and an efficiency in communication, but the confidentiality of the trust parameters remains a great challenge since it may be overheard by the impostor. This demands the need of exchanging the encrypted mathematical values. The proposed machine learning security paradigm provides firm and trustworthy network in spite of establishment over additional network platform. The QoS is improved through support vector machine for denial-of-service attack. The node has to be clustered to accomplish its respective task. The clustering is done with the help of LEACH protocol, where cluster head and Cluster member are fixed to transfer the data in the network. Low Energy adaptive clustering heirarchy (LEACH) propagates energy to abstain from draining of battery and malignant network. A secure framework is built along with encryption and decoding to protect from denial-of-service attack. Acknowledgement-based flooding attack has been focused with the help of support vector machine algorithm. The messages are encoded in from the source node and coded again during transmission phase to obtain the original message. Defending the traditional methodologies, the proposed work provides excellent QoS when compared and tested with other protocols. The results obtained ensure its efficiency when support vector machine technique is combined with encryption scheme.

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Enhanced approach using trust based decision making for secured wireless streaming video sensor networks

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Abstract

The advances in the expanse of image sensors have made it conceivable to make high-resolution picture sensors easily accessible. The amelioration of wireless interactive media sensor networks are found to be greatly increased due to the day to day usage of cameras, microphones and smart devices. A secured multi-hop routing mechanism is addressed in surveillance areas which could be incorporated to the multimedia sensors that are capable of peruse the detected data comprises of recorded images and videos. Also, malevolent sensor hubs could be interjected into the vigilance area in an untrusted

Crowded plant height optimisation algorithm tuned maximum power point tracking for grid integrated solar power conditioning system

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Abstract: Solar energy is the base for both photovoltaic (PV) power generation and plant growth. Inspired by this biological phenomenon, a novel crowded plant height optimisation (CPHO) algorithm was developed for solar PV maximum power point tracking (MPPT). This CPHO-tuned MPPT algorithm was developed with the aim of obtaining the optimal duty cycle (d) for DC-DC boost converter for maximum solar power extraction from PV panels with the help of a proportional-integral controller. Crowded plants regulate the growth of their stem height in relation to neighbouring plants, also known as height convergence. Using this CPHO-algorithm, the stable height of the plant found in a numerical value is taken as the optimal height of the plant. This optimal numerical value was converted into (d) for the converter. Under dynamic weather conditions, the (d) was optimally adjusted by the proposed algorithm to regulate the DC output of the converter. On the utility side, d - q vector control-based voltage source inverter was used for PV power integration into the grid. The performance of the converter control strategy of the proposed CPHO algorithm was compared with perturb and observe algorithm-based MPPT control, which was analysed on MATLAB/Simulink platform.

1 Introduction

The preference for solar energy has reached a peak as it is the world's most popular renewable source for generating electricity. It is evident that around 18% of the people across the globe do not have electrification owing to lack of infrastructure such as power grids to supply electricity, a study states [1]. In the past decade, the Government of India has taken a lot of initiatives such as subsidies to promote solar power generation especially among people who live in remote areas. Furthermore, in order to meet the energy demands for the current scenario, large solar power projects only seem to be the best optimum solution. India has set an ambitious target of generating 175 GW of electric power from renewable energy resources by 2022 out of which 100 GW is planned exclusively from solar energy. Moreover, the cost of solar photovoltaic (PV) module got radically reduced [2, 3] by 26% over the years, 2012–2018.

In terms of the significance of maximum power tracking [4–6] in the PV system, the insolation variation of the sunlight throughout the day causes variation in the output power of the solar PV module. The irradiance value and the temperature of the PV module decide the output of PV proportionately. The above-mentioned effect deteriorates the efficiency of the PV module. Normally, a DC–DC converter is used to extract the maximum power from solar PV. The non-linear characteristic of a PV array is known and there occurs the best operating point [7] where the PV array produces the maximum power. To enhance the efficiency of the solar cell, it is important to concentrate on maximum power point tracking (MPPT) algorithm [8], which is used for harvesting solar energy.

It is no overstatement that the optimisation algorithm is critical for MPPT. Researchers are continuously attempting to find a robust algorithm for solar MPPT controller tuning [9, 10]. A great deal of these algorithms has been inspired by nature and biological systems. In the last decade, meta-heuristic (biology-based) algorithms [11] were proposed as a solution to optimisation problems. Meta-heuristic algorithms cover techniques that begin with the initial set of variables as 'population', which conclude by



achieving the global minimum or maximum [12] of the fitness function.


The most recent bio-inspired metaheuristic algorithms [13] are seed-based plant propagation algorithm, lion optimisation algorithm, optic-inspired optimisation, raven roosting optimisation algorithm, vortex search algorithm, water wave optimisation, collective animal behaviour algorithm, bumblebees mating optimisation, artificial chemical reaction optimisation algorithm, bull optimisation algorithm and elephant herding optimisation [14]. Furthermore, plant-oriented algorithms, in particular [15], are flower pollination algorithm, invasive weed optimisation, paddy field algorithm, root mass optimisation algorithm, artificial plant optimisation algorithm, sapling growing up algorithm, photosynthetic algorithm, plant growth optimisation, root growth algorithm, strawberry algorithm as plant propagation algorithm, runner root algorithm, path planning algorithm and rooted tree optimisation. Even though a number of algorithms are available, the proposed crowded plant height optimisation (CPHO) algorithm smartly regulates the PV power with a DC–DC converter and produces the most extreme conceivable yield.



In this research work, the test system structures two power converters namely PV side converter and grid side converter. The DC–DC boost converter with the proposed CPHO algorithm-tuned MPPT control is used to reap the maximum power from the PV array. In general, DC–DC converters are controlled by well-known perturb and observe (P&O) tuned MPPT since it seems to be easy in terms of implementation. However, it is challenging to determine the best perturbation value. A smaller perturbation value reduces the algorithm tracking performance whereas high-perturbation value results in oscillation when determining maximum power point (MPP). Also, during the solar insolation variation, the P&O algorithm is prone to error and produces large changes in duty cycle variation. Indeed, even incremental conductance and hill climbing MPPT control methods also failed to serve under rapid insolation variation. Besides, P&O consumes more convergence time with fluctuations. The proposed CPHO algorithm enhances the determination of MPP, under rapidly varying atmospheric conditions, with higher accuracy than the





8 A sociocultural study on solar photovoltaic energy system in India: Stratification and policy implication

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Highlights

- Rethinking: Sustainability and progress of solar energy sector in India.
- Key influence on energy policy and solar PV energy system.
- Energy policy-strategy set leveraging statistical methods for participatory planning.
- Policy implication for Solar PV energy system on the basis of pan-India survey.
- Identified major challenges associated with solar energy policy implementation.

Abstract

Cleaner production is a simple defensive mechanism to protect the environment from pollution and depletion of resources. It is also envisioned to minimise the waste and capitalise on natural resources with effective utilization. Solar energy is a natural resource which can be converted into electricity using photovoltaic (PV) system. This article sheds insights on the implementation of solar PV system with interdisciplinary views and analyse motives and barriers for PV adoption by different citizen groups in India. A survey was conducted to understand the people's perception on solar PV energy system and to determine the level of acceptability among the citizens. The survey information was synthesised and consolidated from various perspectives and the result consigns the research findings into technical, human and socio-economic components. The findings were synthesised through cross-cultural, comparative and mixed-

Performance Assessment of Content Based Image Retrieval System Using Particle Swarm Optimization Algorithm and Differential Evolution

E. Ranjith, Latha Parthiban

Abstract: In this paper, a content-based image retrieval (CBIR) system is presented by employing 12 distance measurements and three types of visual parameters, undergo optimization through particle swarm optimization (PSO) and Differential Evolution (DE) algorithm. Here after, it is called as image retrieval system (IRS) method for the convenience. Initially, IRS derives three types of features of an image: texture, shape and color. Consequently, for every feature type, the similarity among the others and query image in a database D will be estimated, and it uses suitable distance measurements. To optimize the IRS, the closely optimum permutations among the features, similarity metrics and optimum weights for 3 similarities in terms of 3 types of features are determined. In this paper, we made a performance analysis of the application of PSO and DE algorithms to optimize the parameters in the IRS. At the end, simulation outcome shows that the DE method dominates the other traditional methods.

Keyword : CBIR; PSO; DE; Similarity metrics.

I. INTRODUCTION

With a consequent growth in digital image counts, for a huge number of files, an efficient digital management and the retrieval method is significant. Initially, by keeping a text annotation (keyword sets), an image is determined. In image database, the process of image retrieval is to compare the text annotation of query image with the images. Consequently, with same text annotation, the method shows an individual image. But, it is very impractical to use text annotation [1]. The following are the important issues: (1) While there is rapid growth in database, it is a time taking task to denote the text annotation for large count of images, (2) They may mark various text annotation for similar image due to the various cognition of users and (3) To demonstrate the ambiguity and diversity of image visual content and it is tedious to use text annotations. Due to these issues, the method of Content based image retrieval system (CBIR) is employed during the image retrieval of annotation-based methods. It is raising problem on the previous decade, so researches over CBIR is the

upcoming trend [2-4]. Previous CBIR studies use unique feature like shape, texture or color. The main method shows that the multicolored objects histograms given an effective data to index large image databases. A technique named histogram intersection is presented to resolve the identification issue that compares the model with image histogram and histogram enhanced version intersection that attains real-time indexing. It give a method known as histogram back projection to resolve location issue that effectively perform this job in crowded scenes. To undertake broad development and evaluation, [2] has presented a texture and color descriptors. It uses different color descriptors that involve color layout descriptors (CLD), scalable color descriptors (SCD), color structure descriptors (CSD), and dominant color descriptors (DCD).

The texture descriptors enclose a homogeneous texture descriptor (HTD) and edge histogram descriptor (EHD) in [2]. For similarity matching, HTD provides homogeneous texture areas with quantized characterization. It computes a local spatial-frequency of image textures statistics. As same as CLD, the EHD derives the edge spatial distribution. The edge distribution is a fine text feature that is helpful for the retrieval of images while the text feature underlying is not homogeneous. But, an image comprises of different types of visual attributes. Through employing one or two features, it is tedious to attain retrieval result with full satisfaction. At present, many relevant studies were done by employing the visual feature combination and to improve the issue [5]. Hence, it is very significant to derive the efficient visual feature and merge these derived features in CBIR. A technique using 3-level DWT and average rates of $L*U*V$ color spaces as image features is presented [6]. The Earth Mover's Distance (EMD) measurement is used as the similarity degree. In [4], the DCD method is used; pseudo-Zernike moments and steerable filter decomposition are used as image features. Feature set for image retrieval is gained by combining texture, color and shape. To derive texture and color features, [5] uses Gabor filter algorithm and 3D color histogram. To choose the features, it uses GA which reduces dimensionality in feature.

In this paper, we made an attempt to compare the performance of the PSO and DE approaches on the color image retrieval system. To extract the images, it uses different types of texture, shape and color features.

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