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A REVIEW OF A FLYING SQUIRREL SEARCH OPTIMIZATION FOR MPPT UNDER PARTIAL SHADED PHOTOVOLTAIC SYSTEM

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Abstract - Partial shade conditions (PSC) are an unforeseen problem for large-scale solar photovoltaic (PV) systems. PSC may reduce the PV system's performance by producing repeated peaks in the power-voltage (P-V) characteristics. For optimal use, the PV system should be run at its global maximum power point, or GMPP. This paper proposes a system based on Flying Squirrel Search Optimization (FSSO) for the tracking of GMPP. The original FSSO is changed to update the squirrel position in the absence of a predator in order to achieve an effective adoption with a significantly shorter convergence time. A quasi-Z-source converter is used in an experimental study of the suggested technique to extract the highest power under PSC. Higher tracking efficiency, a non-oscillatory steady state response, and fewer transients are produced by the suggested design. Experimental and simulation

The suggested technique works better than other well-known maximum power point tracking (MPPT) strategies based on Perturb & Observe (P&O), Particle Swarm Optimization (PSO), and Grey Wolf Optimization (GWO), according to investigations conducted under varied shading patterns.

Index Terms: Flying squirrel search optimization (FSSO), Maximum power point tracking (MPPT), partial shaded conditions (PSC), photovoltaic (PV) system

I. INTRODUCTION

The Solar Photovoltaic (PV) Energy Is A Promising Renewable Source As It Is Omnipresent, Freely Available, Environmental Friendly, And Has A Low Maintenance Cost. A PV System Is Operated At The Maximum Power Point (MPP) To Extract Maximum Power From The PV Source. A Two-Stage PV System Requires A Dc-Dc Converter For The Implementation Of Maximum Power Point Tracking (MPPT), Connected To A Voltage Source Inverter (VSI) To Feed An Ac Load Or For The Grid Interconnection. Of The Various Topologies Of Dc-Dc Converters Used For MPPT, The Most Common Ones Are: Conventional Boost Converter, Z-Source Converter And Quasi-Z-Source Converter. The Traditional Arrangement Of Using Conventional Dcdc Boost Converter Along With A VSI Is Not Only Costly But Also Decreases The Overall Efficiency. Additionally, The Dead-Time Requirement Between The Switches Of A Leg In The VSI Increases Total Harmonic Distortion And Filtering Requirement. A Zsource Inverter (ZSI) Accomplishes Single-Stage Buck/Boost Conversion And Can Overcome The Aforementioned Limitations.

Higher input capacitance is necessary for ZSI operation with PV systems, though, in order to regulate the pulsing current on the input PV side, increase source efficiency, and lengthen the PV system longevity. Conversely, a quasi-Z-source (qZS) converter draws a continuous current from the source but needs fewer rating components.
Thus, qZS converter has been used in the system suggested in this work. When an MPPT scheme is implemented with a converter that is suitably chosen, it must guarantee that the PV system extracts the maximum power possible across a variety of environmental variables, including variations in solar insolation and ambient temperature. Due to non-linear current-voltage (I-V) characteristics and a widely fluctuating power-voltage (P-V) curve with fluctuations in temperature and sun insolation, the MPPT process becomes more complex. Prompt and observe (P&O) and hill climbing (HC) are two well-liked conventional

MPPT approaches. Because of the constantly shifting disturbance in both directions, the HC and P&O techniques oscillate around MPP, which results in power loss.

Although it lessens these oscillations, the incremental conductance (INC) approach does not totally eradicate them. When there is only one MPP in the P–V curve and uniform solar insolation and temperature, the MPPT methods suggested in work well. Nevertheless, these techniques are not appropriate for big photovoltaic installations with several PV modules coupled in series or parallel. The PV installation as a whole performs differently when even one module performs worse. Partial shade conditions (PSC) occur when a portion of the PV array experiences no uniform sunshine as a result of passing clouds or nearby objects casting shadows. PSC results in a lower power output, the amount of which is influenced by the shade pattern (SP) and system setup. PSC causes the P-V curve to have many peaks, and traditional MPPT techniques are unable to differentiate between the local and global peaks, hence they are unable to reduce the power loss brought on by PSC.
There are strategies to reduce the decrease in power generation brought on by PSC. These strategies mostly consist of reconfiguring PV arrays, utilising intricate converter circuit topologies, and enhancing MPPT methods. The most appealing option among these is to use an enhanced MPPT algorithm, which doesn't need making any structural modifications to an already-built system.
As a result, a variety of MPPT methods have been developed to handle the GMPP search under PSC. Among them, the High input data is needed for intelligent control techniques based on fuzzy logic and artificial neural networks (ANNs).

The improvements made to swarm intelligence, such particle GMPP has been tracked using a variety of techniques, including swarm optimisation (PSO), firefly algorithm, artificial bee colony algorithm, grey wolf optimisation (GWO) algorithm, and bat algorithm. For GMPP tracking in PV systems, PSO and its variations have been thoroughly studied because to their ease of design and implementation. A centralised MPPT controller based on PSO was suggested for a multimodal PV system with several converters. The PSO-based MPPT algorithm was used in the direct duty cycle control approach to manage the pulse width modulation (PWM) signal's duty cycle and get rid of proportional-integral control loops. Using traditional PSO for MPPT has two disadvantages: divergence from high-velocity updated particles and a lengthy convergence period from low-velocity particles.

II. LITERATURE SURVEY

The modelling and design of a closed-loop controller for a Z-source inverter. The Z-source inverter is a recently proposed single-stage power converter, and it is capable of operating in both buck and boost modes. Hence, this inverter gives an economical solution for power conversion in distributed generation (DG) applications, particularly by eliminating the need for a two-stage conversion. Moreover, applications such as DG demand quality output waveforms, and additionally, when the system is subjected to input- and load-side disturbances, their effects need to be minimized. This can be achieved with closed-loop controlling. Toward this end, the system is modelled first with large- and small-signal modelling techniques, and relevant transfer functions are derived [1].

The dc-side of the Z-source inverter shows a non-minimum-phase characteristic, and the output voltage of a Z-source impedance network shows a significant overshoot and undershoot, following a step change in the input due to energy resettling. These effects could be transferred to the ac-side, giving rise to the undershoot and overshoot in the ac output as well. Hence, the proposed controllers should be able to minimize such effects. The ac- and dc-sides are considered separately when designing the controllers. An indirect controller is employed in the
Dc-side, whereas the ac-side controller is designed in the synchronous reference frame [2].

a z-source inverter system for a split-phase grid-connected photovoltaic system. The operation principle, control method, and characteristics of the system are presented. A comparison between the new and traditional system configurations is performed. Simulation and experimental results are also shown to verify the proposed circuit and analysis [3].

A quasi-Z-source inverter (qZSI) that is a new topology derived from the traditional Z-source inverter (ZSI). The qZSI inherits all the advantages of the ZSI, which can realize buck/boost, inversion and power conditioning in a single stage with improved reliability. In addition, the proposed qZSI has the unique advantages of lower component ratings and constant dc current from the source.

All of the boost control methods that have been developed for the ZSI can be used by the qZSI. The qZSI features a wide range of voltage gain which is suitable for applications in photovoltaic (PV) systems, due to the fact that the PV cell's output varies widely with temperature and solar irradiation [4].

Maximum power point tracking (MPPT) techniques are used in photovoltaic (PV) systems to maximize the PV array output power by tracking continuously the maximum power point (MPP) which depends on panels temperature and on irradiance conditions. The issue of MPPT has been addressed in different ways in the literature but, especially for low-cost implementations, the perturb and observe (P&O) maximum power point tracking algorithm is the most commonly used method due to its ease of implementation.

A drawback of P&O is that, at steady state, the operating point oscillates around the MPP giving rise to the waste of some amount of available energy; moreover, it is well known that the P&O algorithm can be confused during those time intervals characterized by rapidly changing atmospheric conditions. In this paper it is shown that, in order to limit the negative effects associated to the above drawbacks, the P&O MPPT parameters must be customized to the dynamic behavior of the specific converter adopted. A theoretical analysis allowing the optimal choice of such parameters is also carried out [5].

The energy utilization efficiency of commercial photovoltaic (PV) pumping systems can be significantly improved by employing simple perturb and observe (P&O) maximum power point tracking algorithms. Two such P&O implementation techniques, reference voltage perturbation and direct duty ratio perturbation, are commonly utilized in the literature but no clear criteria for the suitable choice of method or algorithm parameters have been presented. This paper presents a detailed theoretical and experimental comparison of the two P&O implementation techniques on the basis of system stability, performance characteristics, and energy utilization for standalone PV pumping systems. The influence of algorithm parameters on system behavior is investigated and the various advantages and drawbacks of each technique are identified for different weather conditions [6].

The perturb and observe (P&O) best operation conditions are investigated in order to identify the edge efficiency performances of this most popular maximum power point tracking (MPPT) technique for photovoltaic (PV) applications. It is shown that P&O may guarantee top-level efficiency, provided that a proper predictive (by means of a parabolic interpolation of the last three operating points) and adaptive (based on the measure of the actual power) hill climbing strategy is adopted. The approach proposed is aimed at realizing, in addition to absolute best tracking performances, high robustness and promptness both in sunny and cloudy weather conditions. The power gain with respect to standard P&O technique is proved by means of simulation results and experimental measurements performed on a low power system. Besides the performance improvements, it is shown that the proposed approach allows possible reduction of hardware costs of analog-to-digital (A/D) converters used in the MPPT control circuitry [7].

Analysis of the two most well-known hill-climbing maximum power point tracking (MPPT) algorithms: the perturb-and-observe (P&O) and incremental conductance (INC). The purpose of the analysis is to clarify some common misconceptions in the literature regarding these two trackers, therefore helping the selection process for a suitable MPPT for both researchers and industry. The two methods are thoroughly analyzed both from a mathematical and practical implementation point of view. Their mathematical analysis reveals that there is no difference between the two. This has been confirmed by experimental tests according to the EN 50530 standard, resulting in a deviation between their efficiencies of 0.13% in dynamic and as low as 0.02% under static conditions [8].

The many different techniques for maximum power point tracking of photovoltaic (PV) arrays are discussed. The techniques are taken from the literature dating back to the earliest methods. It is shown that at least 19 distinct methods have been introduced in the literature, with many variations on implementation. This paper should serve as a convenient reference for future work in PV power generation [9].

Evaluations among the most usual maximum power point tracking (MPPT) techniques, doing meaningful comparisons with respect to the amount of energy extracted from the photovoltaic (PV) panel [tracking factor (TF)] in relation to the available power, PV voltage ripple, dynamic response, and use of sensors. Using Mat Lab/Simulink and ds PACE platforms, a digitally controlled boost dc–dc converter was implemented and connected to an Agilent Solar Array E4350B simulator in order to verify the analytical procedures.

The main experimental results are presented for conventional MPPT algorithms and improved MPPT algorithms named IC based on proportional–integral (PI) and perturb and observe based on PI. Moreover, the dynamic response and the TF are also evaluated using a user-friendly interface, which is capable of online program power profiles and computes the TF [10].

III. Conclusion

The manuscript deals with the implementation of FSSO based algorithm for GMPP tracking of PV system under PSC. This algorithm has been adopted to exploit its unique advantage of communication between three class of hickory tree, acorn tree, and normal tree flying squirrels and corresponding position update in direction of optimum solution. The technique has been implemented on different PV system having series-and/or parallel- arrangement of PV arrays and exposed to PSC. The implementation is carried out with qZS converter as power electronic interface and results are validated experimentally and compared with other MPPT algorithms namely P&O, PSO, and GWO. Large-scale solar photovoltaic (PV) systems encounter unpredictable partial shaded conditions (PSC). PSC, causing multiple peaks in the power-voltage (P–V) characteristics, potentially downgrades the performance of the PV system. However, the PV system should be operated at global maximum power point (GMPP) for its efficient utilization.

REFERENCES

[1] C. J. Gajanayake, D. M. Vilathgamuwa, and P. C. Loh, "Development of a comprehensive model and a multiloop controller for Z-source inverter DG systems," IEEE Transactions on Industrial Electronics, vol. 54, no. 4, pp. 2352–2359, 2007.

[2] P. Xu, X. Zhang, C. Zhang, R. Cao, and L. Chang, "Study of Z-source inverter for grid-connected PV systems," in 2006 37th IEEE Power Electronics Specialists Conference, June 2006, pp. 1–5.

[3] Y. Huang, M. Shen, F. Z. Peng, and J. Wang, "Z-source inverter for residential photovoltaic systems," IEEE Transactions on Power Electronics, vol. 21, no. 6, pp. 1776–1782, Nov 2006.

[4] Y. Li, J. Anderson, F. Z. Peng, and D. Liu, "Quasi-Z-source inverter for photovoltaic power generation systems," in 2009 Twenty-Fourth Annual IEEE Applied Power Electronics Conference and Exposition, Feb 2009, pp. 918–924.

[5] N. Femia, G. Petrone, G. Spagnuolo, and M. Vitelli, "Optimization of perturb and observe maximum power point tracking method," IEEE Transactions on Power Electronics, vol. 20, no. 4, pp. 963–973, July 2005.

[6] M. A. Elgendy, B. Zahawi, and D. J. Atkinson, "Assessment of perturb and observe MPPT algorithm implementation techniques for PV pumping applications," IEEE Transactions on Sustainable Energy, vol. 3, no. 1, pp. 21–33, Jan 2012.

[7] N. Femia, D. Granozio, G. Petrone, G. Spagnuolo, and M. Vitelli, "Predictive adaptive MPPT perturb and observe method," IEEE Transactions on Aerospace and Electronic Systems, vol. 43, no. 3, pp. 934–950, July 2007.

[8] D. Sera, L. Mathe, T. Kerekes, S. V. Spataru, and R. Teodorescu, "On the perturb-and-observe and incremental conductance MPPT methods for PV systems," IEEE Journal of Photovoltaics, vol. 3, no. 3, pp. 1070– 1078, July 2013.

[9] T. Esram and P. L. Chapman, "Comparison of photovoltaic array maximum power point tracking techniques," IEEE Transactions on Energy Conversion, vol. 22, no. 2, pp. 439–449, June 2007.

[10] M. A. G. de Brito, L. Galotto, L. P. Sampaio, G. d. A. e Melo, and C. A. Canesin, "Evaluation of the main MPPT techniques for photovoltaic applications," IEEE Transactions on Industrial Electronics, vol. 60, no. 3, pp. 1156–1167, March 2013.