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MPPT CONTROLLER BASED ON FPO FOR PV SYSTEM UNDER PARTIAL SHADING CONDITION

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Abstract–

In last decades, renewable energy resources have gathered remarkable attention as the demand of energy is increasing. Solar power is undoubtedly the operational resource in the category of renewable energies as it is available worldwide. Solar power transformed into electricity in two ways; by CSP power plants or Photovoltaic systems. The solar energy is converted to heat and then this energy is transformed to electricity in CSP power plants. However, this transformation of energy is done in a single-step process by means of solar panels and PV technology. This technology is mainly depended on solar irradiance and temperature. For each moment, there is a maximum power point (MPP) and its value is depended on irradiance and temperature. For operating in optimum position it is needed to track and tooperate in that position. In normal condition, there is only a single MPP and no local points. There are various algorithms and techniques analysis the MPPT in this condition. In partial shading condition, there are several local optimums and a global optimum. The usual methods cannot operate sufficiently. Metaheuristic optimization algorithms used to track MPP in condition like normal and partial shading condition. The main advantage of using them is they are fast in operation and they do not trap in local optimums. This work uses FPO in Maximum Power Tracking (MPPT) in PV systems.MATLAB tool used for evaluate a proposed MPPT model in partial shading conditions.

Keywords— MAXIMUM POWER TRACKING (MPPT), FLOWER POLLINATION ALGORITHM , RNENEWABLE ENERGY grid, Stability ,DC/DC converter

I. INTRODUCTION

The DC power converted to AC and synchronize with commercial grids to be transmitted and distributed to demand side . To reduce energy dissipation through the transmission, the power is sent near the demand site after being raised the electric voltage to 66 kV or higher. The power is transformed to 100 V and provided to outlets after multi-processed reduction in voltage at substations and pole-mounted transformers. Efficient transmission and distribution systems for PV generation. Transmission facilities for PV power generation is quite low compared to other generation because they do not yield electricity during night and poor weather.

Electric power storage devices, such as batteries, can absorb fluctuation of PV power generation and equalize power transmission. This scheme reduces capacity of transmission facilities and huge accumulators. Which drastically reduced cost is available for storage devices, we cannot adopt this method when gas turbines put together, with which we are able to adjust output power rather rapidly. The combination of plant can absorb the fluctuation of PV generation and consequently improve the operation transmission efficiency .It requires a parallel-established thermal power plant comparable to the PV, which is a roundabout way for our initial goal, the introduction of a large amount of PV. This method applicable for large-scale PV plants in remote sites have a serious problem on economic efficiency. We need a new power system that enables the introduction of a massive amount of distributed PV units in demand sites. This paper proposes DC micro grid systems as an option for such a purpose.

Purpose and Architecture of the DC Micro Grid System

(1) Increase the distributed PV units.

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(2) Reduce energy dissipation and facility costs resulting from AC/DC conversion by integrating the junction between a commercial grid and DC bus which connects PV units and accumulators.

(3) Supply power to loads via regular distribution lines (not exclusive lines for emergency) even during the blackout of commercial grids.

II. SIMULATION RESULTS -1

The modification of the MPPT Perturb and Observe (P&O) algorithm for Constant Power Generation (CPG) is proposed that combines MPPT P&O with the power control settings to the maximum limit of solar PV. This method can set up 2 operating conditions of the solar PV namely MPPT mode and CPG mode. The MPPT mode works when the solar PV output power is smaller than the reference power to maximize solar PV output power. However when the solar PV output power is more than or equal to the reference power then the CPG mode works to limit the solar panel's output power. Based on the simulated results of this MPPT-CPG control shows the load output voltage response can be kept constant 48 V with less than 5% error that has been verified using a variety of irradiance and reference power.

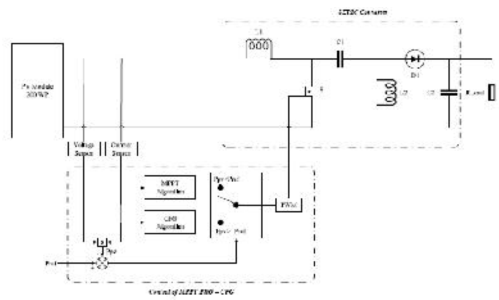

Figure 1. Block diagram operational principles MPPT P&O-CPG.

The block diagram system is depicted in Fig.1. shows that on this system using a solar PV 200 WP related SEPIC converter with a variable resistive load of 48 Volts (0-200 Watts). There are two voltage sensors and two sensors, both sensors are installed on the input SEPIC converter and the output side. The current and voltage sensor on the input side of the SEPIC converter is to provide the voltage and return the current information to the control algorithm system MPPT P&O-CPG. While the current and voltage sensors on the output side of the SEPIC converter are to monitor the voltage and load output power whether according to the currently active MPPT P&O or CPG control modes.

a) MPPT P&O mode (Ppv<= Pref), where the MPPT P&O algorithm should track maximum power and oscillate around the MPP.

b) CPG mode (Ppv>Pref), where PV output power is limited to Pref. In this CPG mode, PV voltage continuously interrupted a point called Constant Power Point (CPP) (Ppv = Pref). Areas of operation for MPPT and CPG modes in PV system for a day.

III. DESIGN OF MPPT P&O-CPG

On the MPPT method P&O-CPG consists of 2 modes, namely MPPT mode and CPG mode. In determining which mode is activated based on 2 variables: solar panel output power (PPV) and reference power (Pref). Solar panel output power is obtained from the readings of the current sensor and the voltage on the solar panel output. While the reference power is the boundary power that is inputted. When PPV is < = Pref then the MPPT mode is enabled and when PPV >Pref then CPG mode is enabled. This active mode will determine the duty cycle of the SEPIC converter.

Control system generated loads are saved from the failure of excess voltage. The flowchart of the MPPT P&O-CPG system is shown in Fig. 2.

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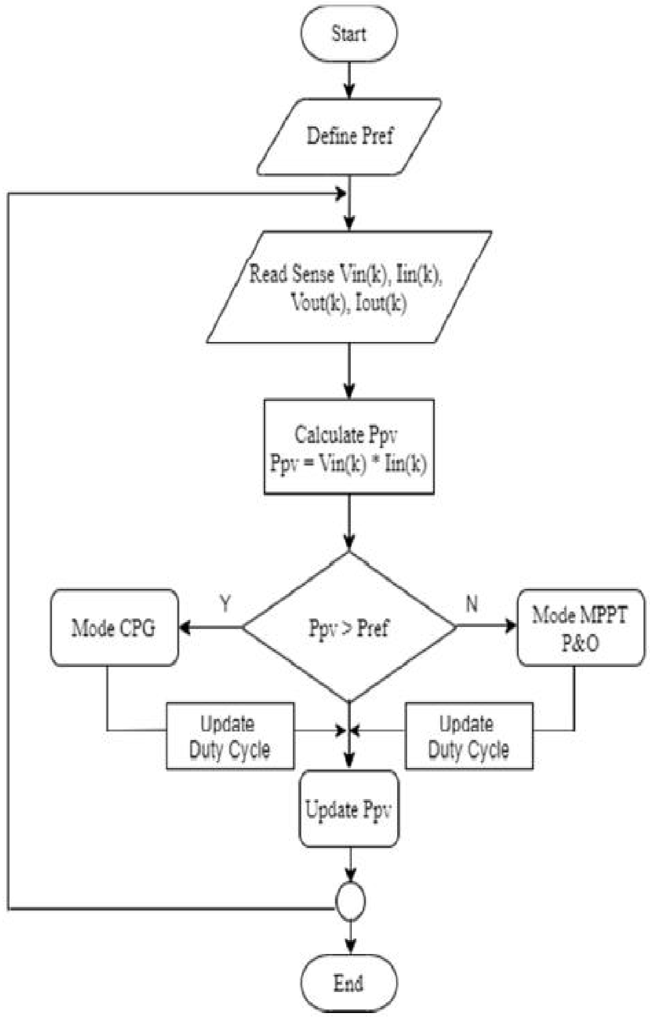

Figure 2: Flowchart of MPPT P&O-CPG system.

In observed technique MPPT P&O method for MPPT mode. The MPPT P&O method compares the output power while being measured and previously to be converted into a duty cycle by taking the current-voltage and data on the solar panels through the current sensor and voltage on the input SEPIC converter. If the PV output power changes to increased voltage changes ($dP/dV > 0$), then perturbation in the same direction is done to move the working voltage of the solar panels forward towards the MPP. Whereas if the power change output to a change in voltage is reduced ($dP/dV < 0$), then the direction of the perturbation reversed. This process is repeated periodically until the MPP is reached. The system then oscillated around the MPP. The MPPT P&O Flowchart method is shown in Fig. 3.

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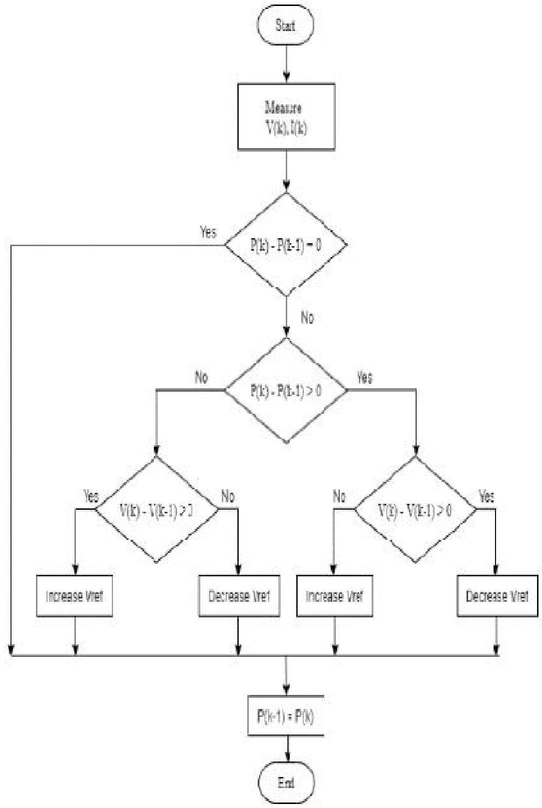

Figure 3: Flowchart of Modified MPPT P&O method for CPG.

Then in Fig.2 shows the modified flowchart of the P&O algorithm MPPT. Both modified methods are almost identical to the original MPPT P&O method, but in the modified MPPT P&O method, the Vref value is in the reverse direction. By doing this technique it is possible to force the solar PV operation to the left of the MPP and allow it to control the feedin power on variable resistive loads.

IV. STIMULATION SOFTWARE

Simulink is a software package for modelling, simulating, and analyzing dynamical systems. It supports linear and nonlinear systems, modelled in continuous time, sampled time, or a hybrid of the two. Systems can also be multi rate, i.e., have different parts that are sampled or updated at different rates. For modelling, Simulink provides a graphical user interface (GUI) for building models as block diagrams, using click-and-drag mouse operations.. This is very different from previous simulation packages that require you to formulate differential equations and difference equations in a language or program. Simulink includes a comprehensive block library of sinks, sources, linear and nonlinear components, and connectors. User can also customize and create your own blocks.

Models are hierarchical, the models are built using both top-down and bottom up approaches the system can viewed at a high level, then double-click on blocks to go 5 down through the levels to see increasing levels of model detail. This approach provides insight into how a model is organized and how its parts interact.The Power System Block Set or Sim Power System (after renamed) had just introduced to the modeling environment of Simulink by Mathworks. The Power System Block Set provides tools for modeling and simulating electrical power systems within Simulink using the standard notations for electrical circuits.

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V. CONCLUSION

New approach to handle a constant power generation. This suggested fast and intelligent control method is robust over negative impedance instabilities, which is very usual in DC/DC converters dominated by DC modern grids and other similar power electronic devices. this paper propose the MPPT P&O-CPG method to be able to control solar panels that work on 2 conditions MPPT operations and CPG operations to avoid overvoltage on the load. This MPPT P&O-CPG method has been evaluated through a PSIM simulation. Simulated results indicate that the MPPT mode is identified when the load requirements are greater or equal to the solar power panel (PPV < = Pref) and the voltage on the output side of the < 48V.

VI. FUTURE WORK

This paper further work on the analysis on three-dimensional duty cycle control method to achieve steady state

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