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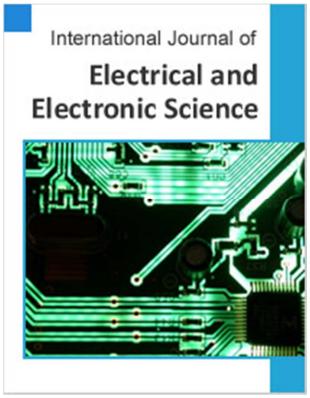

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Maximum Power Point Tracking with Solar Energy

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Abstract
Maximum power point tracking MPPT is an electronic DC to DC converter for optimizing the interfacing between solar energy with battery system. The main weakness of MPPT is that it is slow response. To reduce this problem, the proposed proportional-derivative PD controller with MPPT is used to optimize the whole system. The aims of PD controller are to decrease the rise time, minimize the overshoot, and improve the stability of system. This new approach of MPPT with solar energy based on two PD controllers is designed and executed using Matlab- Simulink with Toolbox. The simulation results illustrate that the system with PD controller is more accuracy with better performance over the traditional MPPT.

1. Introduction

Many researchers suggested a lot of studies to improve the performance of maximum power point tracking (MPPT) and to increase efficiency of system under the variation of conditions [1]. Voltage of MPPT is not determined of temperature [2], and the relationship between the MPPT voltage with open circuit voltage is linearity [3]. In addition, the MPPT system with look-up table is also applied [4] with nonlinear control of current [5]. The MMPT is enhanced based on try and error by using observe and perturb (O and P) [6] with its adaptations [7, 8] and increasing the conductance [9, 10]. Furthermore, theoretically the intelligent algorithms are also suggested to modify MPPT system which is possible used practically based on neural network NN [11]. In this method, NN aim was to generate best construction using perturbs and observe, and online optimization of MPPT controller via NN is used in the photovoltaic system [12–16]. Also, fuzzy logic controller was used to enhance the MPPT controller (FLC) [17–22], and Particle swarm optimization (PSO) was applied too [23]. Several methods to improve the MPPT controller were discussed in the reference [24]. It is obvious two Fuzzy Logic and Genetic Algorithm were combined to increase the efficiency of MPPT [25]. In contrast, the main problems of the suggested methods mentioned above are either caused sluggishness of the system performance or make the MPPT system more complicated.

In this paper, new approach of MPPT with solar energy based on PD controller to removes the problems that cause the deterioration of system. Here, the two PD controllers are used to optimize the voltage and current of MPPT as results to increase the efficiency of system.

2. Proposed Method of PD-MPPT Controller

The PD controller is widely used in the industrial applications because of its simplicity and no need mathematical model of system. The classical MPPT is slow response which

degrades the system performance. Therefore, the two PD controllers are the best solution to solve the classical MPPT problem. The input to first PD controller is the error (e) between the reference current I_{ref} and output current I_{out}. in addition, the input to second PD controller is the error (e) between the reference voltage V_{ref} and output current V_{out}. The outputs of two PD controllers are applied to the MPPT controller to optimize the whole system performance. The Simulink of presented PD-MPPT is shown in figure 1.

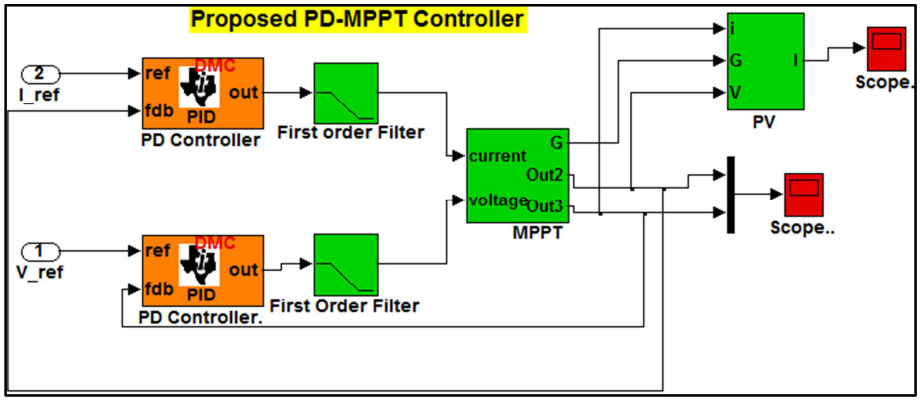

Figure 1. *Proposed PD-MPPT.*

3. Simulation Results

The new method of PD-MPPT controller is designed and constructed by using Matlab Simulink.

From figure 2 it can be seen that the efficiency response of PD-MPPT controller is better than classical MPPT.

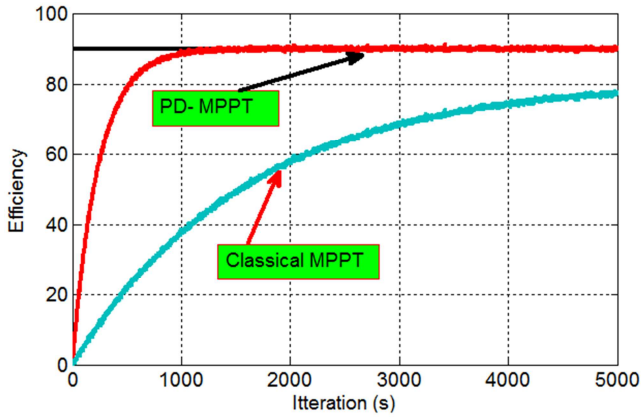

Figure 2. *Comparison the efficiency response.*

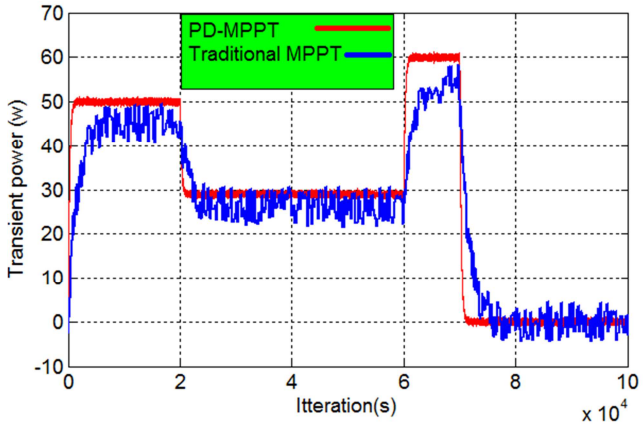

Figure 3. *The behaviour of transient power under load disturbance.*

In addition, in figure 3, the behaviour of transient power is smooth and not affect with load disturbance while the classical system had ripple and distortion.

Figure 4 indicate the current is free of distortion in the proposed PD-MPPT as compared with traditional MPPT controller.

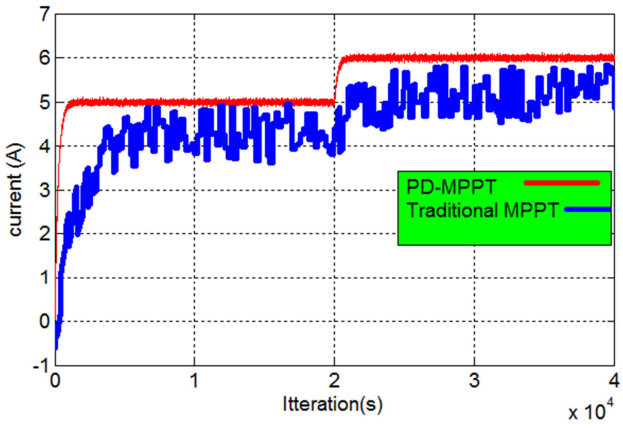

Figure 4. *Response of current.*

4. Conclusion

In this paper, the proposed PD-MPPT controller is compared with classical MPPT. The two PD controllers reflected the authority of MPPT over the traditional system. The classical MPPT is improved based on PD controller as results to enhance the complete system. The PD controller is used to decrease the steady state error and to increase the efficiency of system. Finally, the system with 2-PD controllers is more robustness and high reliability than MPPT controller.

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