

PSO based MPPT for Photovoltaic System

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Abstract: Sun based Photovoltaic is viewed as one of the most encouraging energy source today and in the approaching time as it is fueled by environmentally friendly power source i.e sun and significant measure of innovation improvement has occurred. The issue that lies with the Photovoltaic is that of significant expense and less change effectiveness. The arrangement comes as boosting the power yield like clockwork. There are various strategies called as MPPT (Maximum Power Point Tracking) procedures that when applied prompts most extreme power yield. In this work PSO based MPPT is carried out.

Keywords:Sensors, MPPT, Solar Panel Board, Chopper based Converter, Digital controller

1 Introduction

India receives an enormous sun oriented benefit with an expected 5000 trillion kWh of energy accessible through sun consistently with most parts getting 4-7 kWh of energy for every day [1]. The need is to remove this sun powered energy to the greatest degree.

Taking into account photovoltaic frameworks that changes sunlight based energy into power, there is an additional benefit in using this technique for power age when contrasted with different wellsprings of age. Sun powered energy extraction from photovoltaic being sans contamination and the source being liberated from cost gives a wide extent of tackling power from sun oriented.

With the worldwide worry for contamination, issue of an unnatural weather change and accentuation on decrease of carbon impression, sunlight based PV frameworks have come up as a very much acknowledged wellspring of power. Be that as it may, because of the total reliance of PV frameworks on daylight as the wellspring of energy, the variables like climatic and natural circumstances influence the result of the PV framework. The other issue that comes is of high beginning expense of PV framework while thinking about a sun oriented based framework. The answer for above issue comes in the way that at whatever point sun's energy is accessible, separate it to the greatest [2].

Separating greatest energy from PV boards calls for most extreme power point following (MPPT) strategies. The various techniques for most extreme power extraction incorporates irritate and notice, open-circuit voltage, steady conductance, slope climbing, hamper, brain and fluffy rationale strategies and others. These strategies function admirably for uniform sunlight based insolation and temperature [3].

Sun powered insolation and temperature are the two principal factors on which the result of the PV board depends. For steady upsides of sun based insolation and temperature, there is a solitary top in the

power-voltage bend for a PV module. On account of changing sun based insolation and temperature there are more than one top at the PV module yield [4]. The adjustment of these boundaries is a direct result of halfway concealing condition emerging because of various natural circumstances. These previously mentioned regular strategies settles at a nearby top for the situation while fractional concealing happens. Consequently numerous changes are carried out in these MPPT techniques to get to the worldwide pinnacle and various papers exists in such manner [5]-[7].

PSO calculation based MPPT methods gives the benefit that with the tuning of different boundaries in the calculation and making a few changes, the calculation can function admirably in the halfway concealing circumstances. The worldwide greatest can be found out with changing natural circumstances. In this work, PSO based MPPT is performed for various insolation levels.

2 PSO Overview

Particle Swarm Optimization is self-learning based calculation strategy applied to take care optimization issues. It come across discovered in 1995 by Eberhart (electrical engineer) and Kennedy (social scientist). This calculation is relevant for worldwide arrangement of an issue characterized in any aspect. In PSO, various particles are arbitrarily chosen in the scope of the arrangement. These arbitrarily acquired particles are the beginning stage for this strategy to start.

When the calculation begins, the particles refreshes its qualities as per two straightforward conditions. These conditions are based with the end goal that the particles in the middle between themselves, refreshes themselves and moves towards the expected answer for the issue.

The two equations on which PSO is based are-

$$v_i(k + 1) = wv_i(k) + c_1r_1(p_{best,i} - x_i(k)) + c_2r_2(g_{best} - x_i(k))$$

$$x_i(k + 1) = x_i(k) + v_i(k + 1)$$

$$i= 1, 2, 3, \dots, N$$

where x_i comment to the point of i th particle, v_i comment to the velocity of i th particle, k is for number of iteration at which the algorithm is running, c_1 and c_2 are the coefficients, r_1 and r_2 are the random number with a range between 0 and 1.

P_{best} stores the value of the individual best of respective particle and G_{best} stores the global best among the different particles.

The step by step diagram of PSO is displayed in Fig. 1

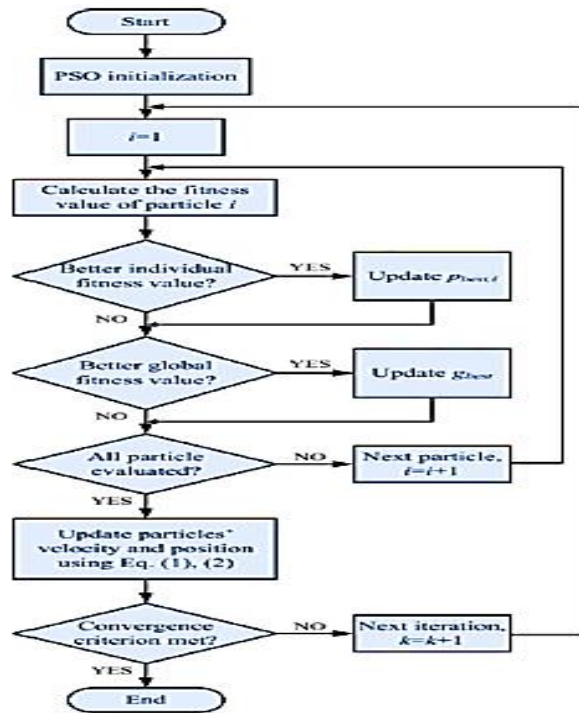


Figure 1 PSO Algorithm

3 Methodology Followed

The methodology that is continued in this work to remove greatest power across the PV board is general in nature. The impedance across the PV panel is changed so that the maximum power is acquired across the module. The impedance is shifted across the PV board with a DC-DC converter. The DC-DC converter is middle between the PV board and the load. The expected duty cycle of the converter that gives the most extreme power is determined with the help of the PSO calculation. The whole PV system is implemented in MATLAB. The algorithm is executed in coded form in MATLAB. The overall format of the PV framework with algorithm is displayed in figure 2.

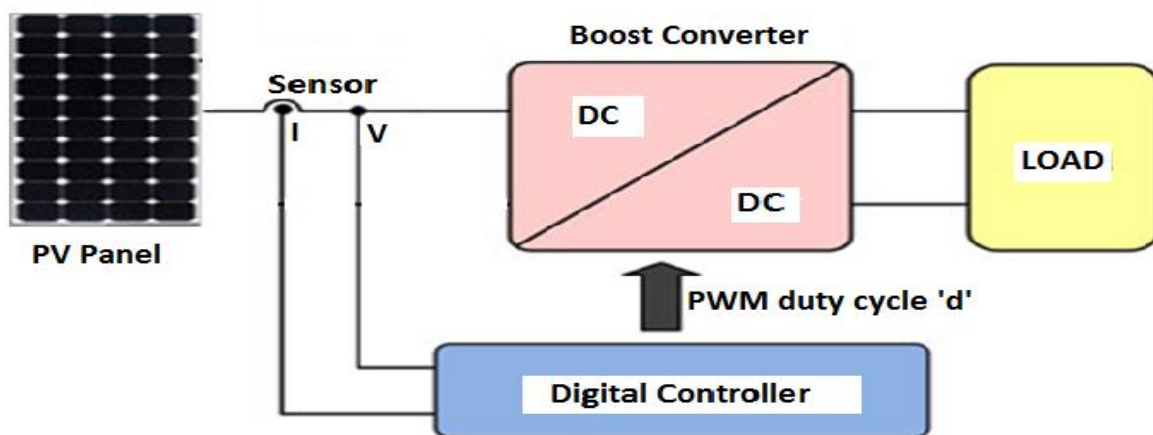


Figure 2 MPPT implementation.

4 Simulation

The simulation is shown in figure 3.

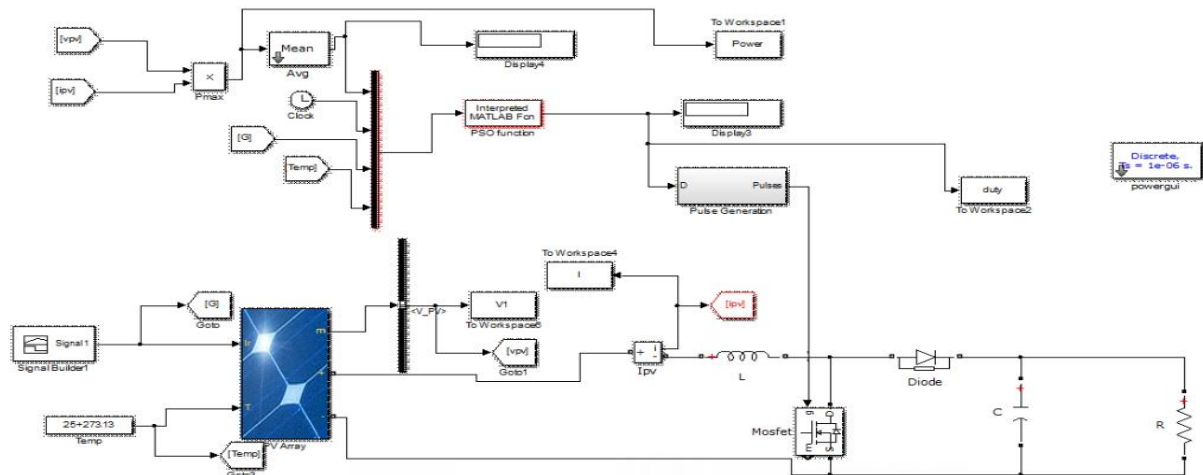


Figure 3 Simulation Model

The PV panel rated at $V_{oc}=21.24$, $I_{oc}=4.75$ A, $V_m=17.64$ V, $I_m=4.54$ A. The DC to DC converter here is a Boost converter with the following component values- $L=40$ mH, $C=80$ μ F, $R= 100$ Ω . The simulation is run at 4 seconds. With the changing of insolation levels, the output result across the PV panel is observed.

5 Results

The result across the PV board is considered to check for the most extreme power point following done by the PSO calculation. With the change in insolation levels, disturbances in the system depicting partial shading are created. Fig. 4. results the different insolation levels for which the algorithm is used. The different levels considered are- 800, 1000, 900, and 600 (W/m²) and they are altered at 2 sec, 3sec, and 8.5 sec respectively. Thus there is a artificial depiction of partial shading.

Fig. 5, fig. 6, fig. 7, fig. 8 depicts duty cycle, current, voltage, and power with the change in insolation level. With the disturbance created, the system settles down again at maximum value of power which is 45 W.

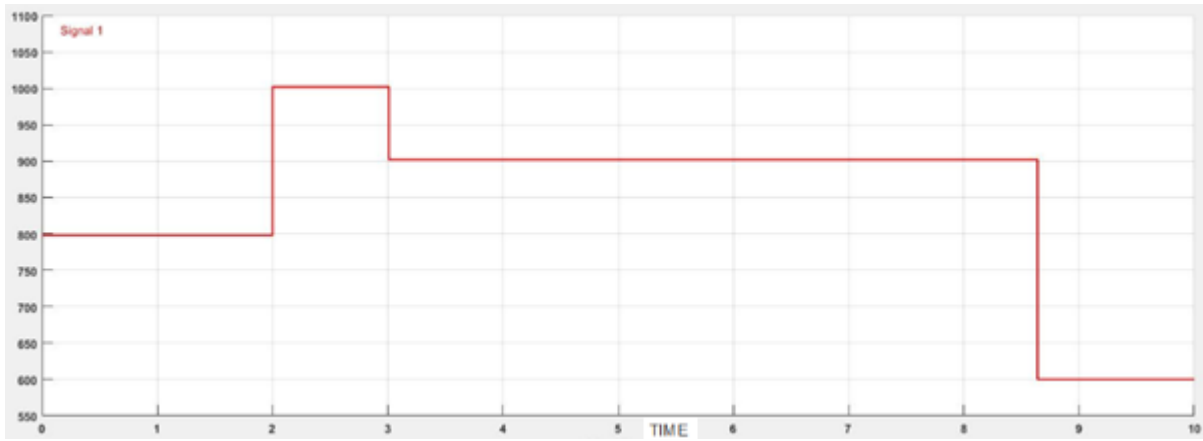


Figure 4 Different insolation level

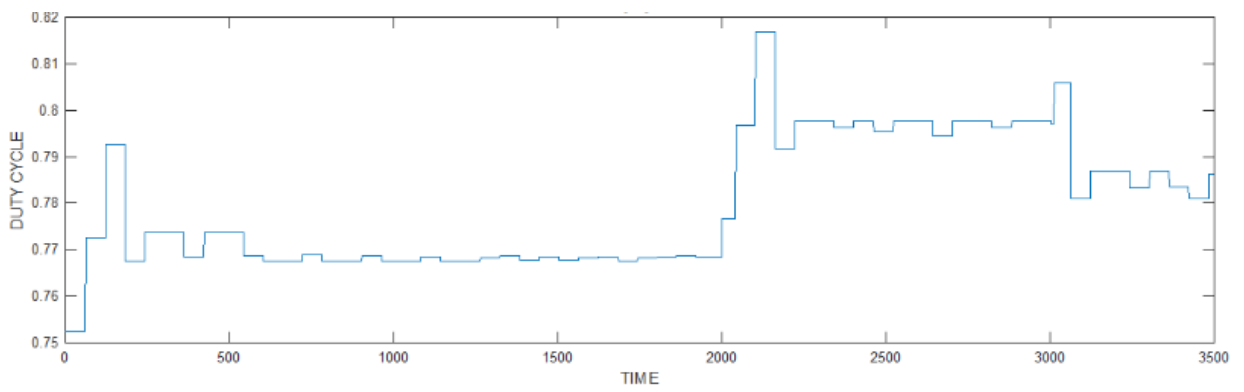


Figure 5 Duty cycle profile

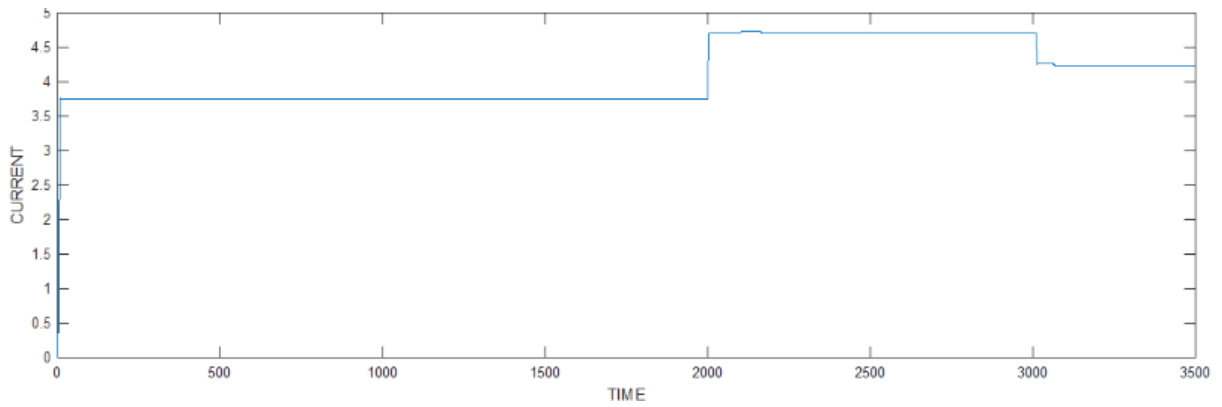


Figure 6 Current profile

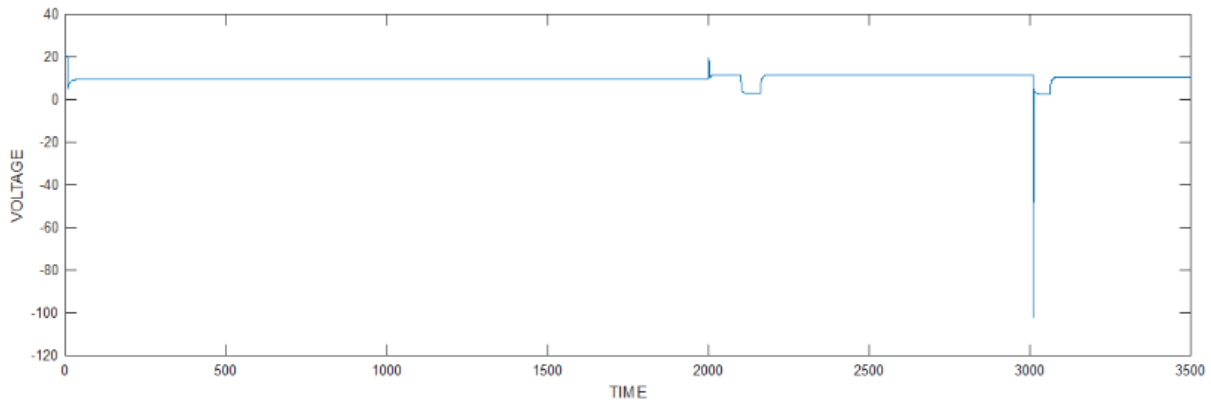


Figure 7 Voltage profile

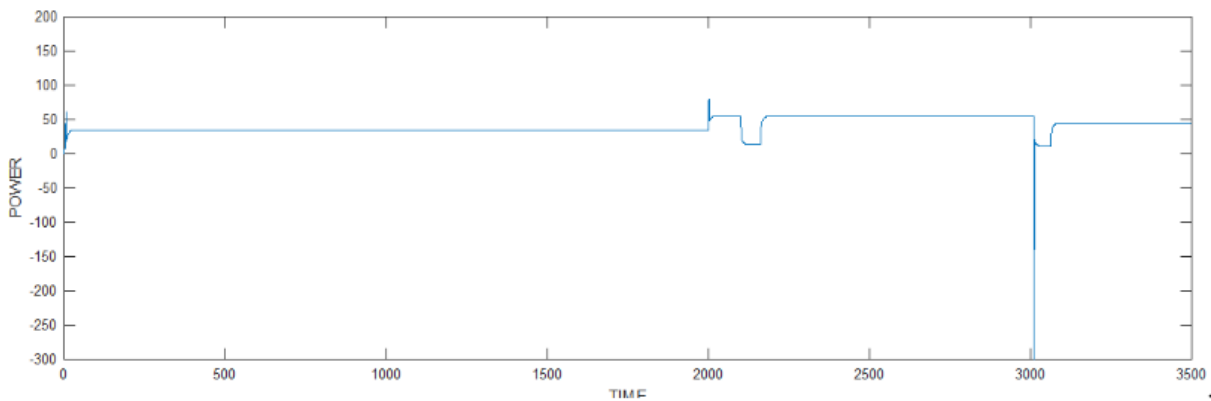


Figure 8 Power

6 Conclusion

In this work, MPPT based on PSO algorithm is implemented. With the change in insolation level, partial shading condition is mimicked. The system settles down at maximum value of power with change in insolation levels.

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