FUZZY CONTROL BASED ON PERTURB AND OBSERVE ALGORITHM FOR MAXIMUM POWER POINT TRACKING PHOTOVOLTAIC SYSTEMS

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FUZZY CONTROL BASED ON PERTURB AND OBSERVE ALGORITHM FOR MAXIMUM POWER POINT TRACKING PHOTOVOLTAIC SYSTEMS

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I. INTRODUCTION

Photovoltaic (PV) energy is amongst the most helpful renewable and sustainable energy sources since it offers a variety of benefits. Because it has a number of advantages [1], including being free, having a long life of usage, requiring very little maintenance, having no moving parts, and not being polluted [2]. However, one of the most significant PV flaws is that it has a nonlinear feature with only one point of operation where the generated power is at its peak, known as the Maximum Power Point (MPP), which is affected by environmental conditions such as temperature and irradiance [2]. It is critical to working around the MPP in order to optimize the electricity generation. The maximum power tacking controller is required to harvest the maximum power from the Photovoltaics System (PVS) by managing the DC-DC converter in order to effectively pursue this goal, many researchers deal with this topic [3][4][5]. In order to improve the response of traditional MPPT techniques, the researchers are still improving these by mixing with them and the intelligent technics to form a hybrid and optimized approach. The performance and the intricacy of these approaches, as well as their topologies and hardware implementations, varies. However, these techniques have a mutual objective is to optimize the efficiency of the PVS. The Perturbation and Observation (P&O) algorithm is straightforward and low-cost [3][6]. However, it has a flaw in steady-state response instead of tracking the MPP consistently, it causes the system output to bounce about. Furthermore, the P&O technic is unable to adapt to environmental conditions variation since it is unable of distinguishing between changes in power owing to environmental causes and changes due to internal perturbations [3][6]. The main objectives of this work are tracking and operating at the MPP based on P&O and fuzzy logic controller (FLC), regulating the DC link voltage to 650 V. The suggested approach is simulated in Matlab/Simulink environment. The PVS has been tested with KC200GT solar panel under various operating conditions.

II. PV SYSTEM MODELING

A stand-alone PVS is shown in Fig. 1. In this study, we use a PVS compound of ten modules five connected in series and five connected in parallel in order to produce a power of 4 KW at the PVS output, a buck-boost converter, and a DC-AC inverter, including an LC output filter, DC–DC bidirectional converter is connected between DC-link and battery.

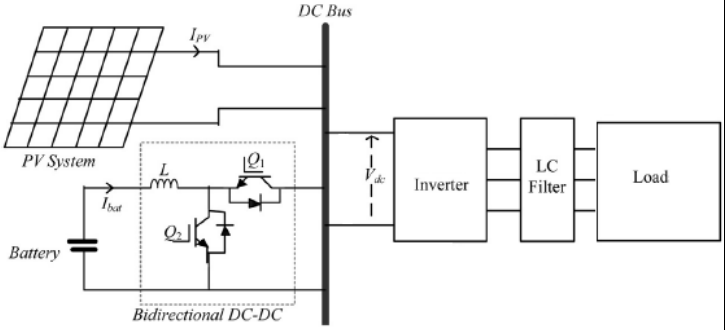


Fig.1. Schematic of the stand-alone PVS.

III. RESULT AND DISCUSSION

The electrical specifications, at standard test condition (solar radiation of 1000 W/m^2 and the temperature of 25C°). Fig.2 illustrates the PVS simulation results under various irradiation conditions; based on the findings, it can be concluded that the FLC based P&O (FLC-PO) MPPT algorithm outperforms both MPPT algorithms in terms of time response, oscillation, and stability, even conclusion for the output voltage as shown in Fig. 3.As can be shown in Fig. 4, the DC bus voltage (Vdc) agrees with the reference voltage (V*dc = 650 V) with good precision and stability, with no dependency on solar irradiation fluctuations. The load current is illustrated by Figure 6. The load current has been analyzed and the results are presented in Fig. 7, where this current has a total harmonic distortion value of THDv =0.93 %.

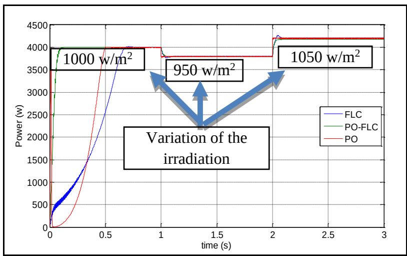


Fig.2.Output power of the PVS

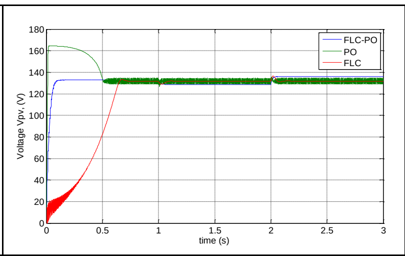


Fig.3.Output voltage of the PVS

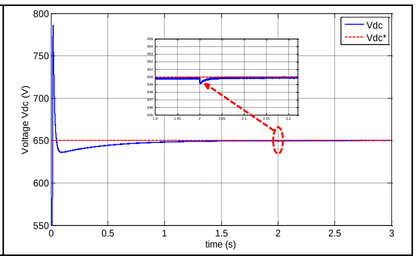
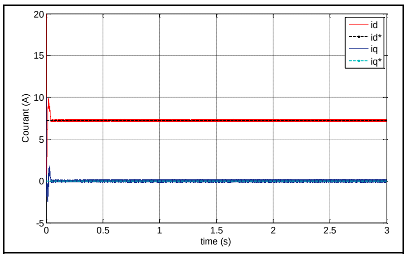


Fig. 4.DC bus voltage



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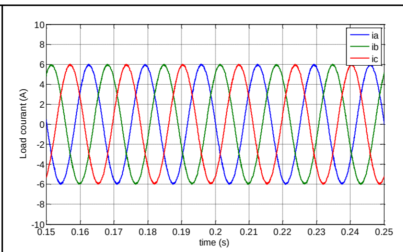

Fig.6. Load current.

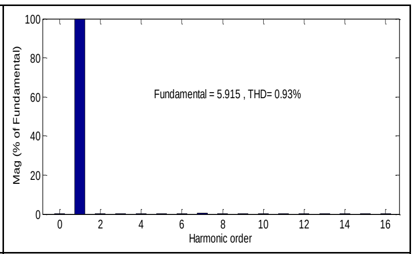

Fig.7 THD of current

IV. CONCLUSION

This paper presents a simulation study of the PVS with MPPT techniques which is fuzzy logic controllers based perturb and observe algorithm. Simulation results show that FLC-PO MPPT is able to track the MPP with fast response and a less oscillating.

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