Comparative Study Between Intelligent MPPTs for PV System: PSO and ANFIS using Subtractive Clustering Partition

Nadjib Mekhaznia[1*], Riad Khenfer[2]

[1]Laboratory of Advanced Electronics and Telecommunications, University of Bordj Bou Arreridj, Algeria
[2]Electrotechnical Engineering Laboratory, University of Bordj Bou Arreridj, Algeria
*Corresponding author's email: nadjib.mekhaznia@univ-bba.dz

ABSTRACT

The photovoltaic system is highly dependent on weather conditions. Under these conditions, conventional MPPTs have shown their limits in giving the maximum power point. Focusing on the above-mentioned problem, in this paper, we designed two intelligent MPPTs based on Particle Swarm Optimizer (PSO) and Adaptive Neuro-Fuzzy Inference System (ANFIS) using subtractive clustering partition (SCP). ANFIS using SCP has significantly improved load voltage response by suppressing oscillations during rise time and has better performance than PSO-based MPPT.

Keywords: PV MPPT, PSO, ANFIS

1 Introduction

Among all possible renewable resources, photovoltaic power generation has been proved to a very powerful and promising potential [1] due to absence of investment in fuel cost and wide range of power scalability. Further, the PV power system has the added advantage of operating in both grid connected mode and isolation mode by integrating with proper power electronics devices [2], [3]. However, the PV systems generate intermittent power under fluctuating weather which is the main issue that must be taken in consideration [4], [5]. The power-voltage and current–voltage characteristics are responsible for the power generated from the PV cell [6]. The well-known MPPTs are Incremental conductance (IC), perturb and observe (P&O) and constant voltage (CV) method [7]- [10]. P&O was extensively used due to its simple control method as well as the minimum number of its input parameters. However, the use of this algorithm leads to a loss in power due to an enormous oscillation in the area of maximum power point (MPP). Others, like IC methods has been proposed by some researchers [11].

2 Methodology

The results obtained of the load power of the MPPT based PSO present an oscillation during the rise time. To remedy this disturbance, we have tested the MPPT based on ANFIS using subtractive clustering partition (SCP) which has given a reduced rise time and without oscillations.

3 Results and Discussion

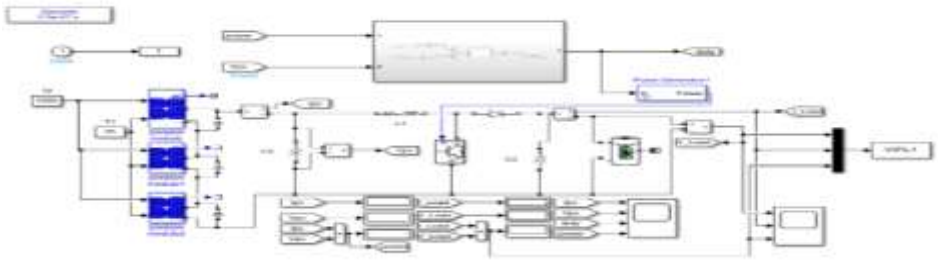

Figure 1: *Simulink of the simulation*

The system is controlled by two MPPTs based on PSO and ANFIS (Figure 1). The parameters of the ANFIS are: Range of influence=0.3, squash factor=1.25, accept ratio=0.5, and reject ratio=0.15.

DOI: 10.21467/abstracts.163 ISBN: 978-81-965621-5-1 (eBook)

Table 1 shows the electrical characteristics of the PV module. Figure 2 shows the load power of the two responses.

Table 1 : *Electrical characteristic of the PV module*

Maximum power (W)	85.383
Cells per module (Ncell)	36
Open circuit voltage Voc (V)	22
Short circuit current Isc (A)	5.2
Voltage at maximum power point Vmp (V)	17.9
Current at maximum power point Imp (A)	4.77

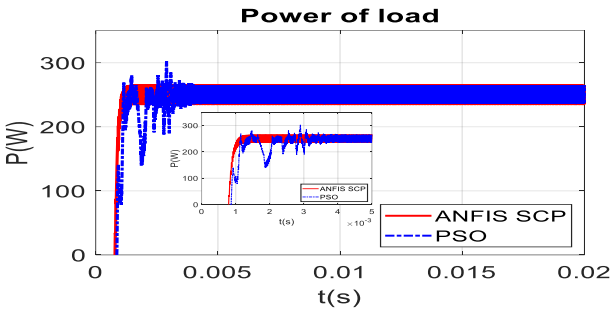

Figure 2: *Load power*

4 Conclusion

The load power response of the MPPT based on ANFIS with SPC does not show oscillations during the rise time like the PSO response. It has less rise time and overshoot. Intelligent MPPTs have a future in this vital area and the development of semiconductor components could improve the PV performances.

5 Competing Interests

The authors declared that no conflict of interest exists in this work.

How to Cite

N. Mekhaznia, R. Khenfer, "Comparative Study Between Intelligent MPPTs for PV System: PSO and ANFIS using Subtractive Clustering Partition", *AIJR Abstracts*, pp. 99–100, Feb. 2024.

References

[1] Doty, G., McCree, D., Doty, J., Doty, F., "Deployment prospects for proposed sustainable energy alternatives in 2020," Proceedings of the ASME 2010 4th International Conference on Energy Sustainability, pp. 171–182, 2010.

[2] Figueres, E., Garcera, G., Sandia, J., Gonzalez, E. F., Rubio, J.C., "Sensitivity study of the dynamics of three-phase photovoltaic inverters with an LCL grid filter," IEEE Trans Ind Electron, 56(3): 706e17, Mar. 2009.

[3] Datta, M., Senjyu, T., Yona, A., Funabashi, T., Chul, H. K, "A coordinated control method for leveling PV output power fluctuations of PV-diesel hybrid systems connected to isolated power utility," IEEE Trans Energy Convers Mar. 2009; 24(1): 153e62.

[4] Gaëtan, M., Marie, L., Manoël, R., "Theologitis IT, Myrto P. Global Market Out look For Photovoltaics 2013-2017," Proceedings of the European Photovoltaic Industry Association,Belgium, pp. 1–60, 2013.

[5] Moradi, M.H., Reza Tousi, S.M., Nemati, M., SaadatBasir, N., Shalavi, N., (2013) "A robust hybrid method for maximum power point tracking in photovoltaic systems," Sol. Energy 94, pp. 266–276.

[6] Tey, K.S., Mekhilef, S., "Modified incremental conductance MPPT algorithm to mitigate inaccurate responses under fast-changing solar irradiation level," Sol. Energy 101, pp. 333–342, 2014.

[7] T. Esram,P. L. Chapman, "Comparison of photovoltaic array maximum power point tracking techniques," IEEE Transactions on Energy Conversion22 (2), pp. 439–449, 2007.

[8] E. Irmak,N. Güler, "Application of a high efficient voltage regulation system with MPPT algorithm, Electrical Power and Energy Systems," 44 (1), pp. 703–712, 2013.

[9] B. B. J. D. Retnam,A. Gounden, "Power Electronic Interface with Maximum Power Point Tracking Using Line-commutated Inverter for Grid-connected Permanent Magnet Synchronous Generator, Electric Power Components and Systems," 43 (5), pp 543–555, 2015.

[10] V. Salas, E. Olias, A. Barrado, A. Lazaro, "Review of the maximum power point tracking algorithms for stand-alone photovoltaic systems, Solar Energy Materials and Solar Cells," 90 (11), pp. 1555–1578, 2006.

[11] D. Mi,Y. Jian, P. Ke, "Zero average incremental conductance maximum power point tracking control for photovoltaic system," Proc CSEE 30, pp. 48–53, 2010.

ISBN: 978-81-965621-5-1

Series: AIJR Abstracts

DOI: 10.21467/abstracts.163