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Improved Power Generation From PV Array Under Partial Shading Conditions by Shade Distribution Using Magic Square View Configuration

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Abstract

The main purpose of this paper is to model, simulate, and improve the performance of different 9 × 9 PV array configurations under different Partial Shading Conditions (PSCs) in order to extract the maximum power by defeat the mismatching power losses. Hence, PSCs reduces the performance of Photovoltaic (PV) arrays and increase the Local Maximum Power Points (LMPPs) on output characteristics P-V due to mismatching power losses between the PV panels. For this, Total-Cross-Tied (TCT) [1]–[4], and proposed Magic Square View (MSV) PV array topologies are considered for the study under Short Narrow shading patterns. PV array configurations enhancements and their investigations are carried out with regard to the comparison of the Global peak of outlet power (GP). The parameters of the PV array configurations are performed in MATLAB/Simulink software.

Key words: PV power generation, TCT, MSV, Photovoltaic.

Results and Discussion

A 9X9 PV array is connected in TCT configuration [4], [5] and subjected to Short Wide shading patterns to evaluate the performance of the MSV based configuration method. The results are performed by simulating the different reconfiguration techniques in MATLAB/Simulink environment. PV of 80 W panel is used for simulation [6]. The results obtained are compared with TCT configuration techniques for the giving shading patterns. Further PV curves are also plotted for comparative analysis of TCT and proposed MSV based reconfiguration technique.

Short Narrow Shadow

The PV array MSV configurations is subjected to three different insolation levels 900 W/m^2, 600W/m^2, 400W/m^2 and 200W/m^2 respectively. The same shading pattern is applied to the TCT configuration [5].

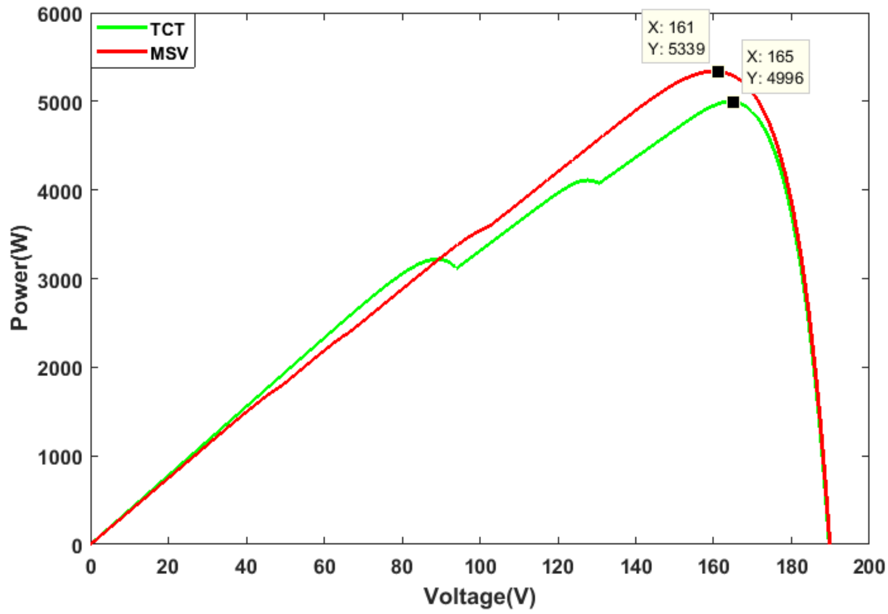

Figure. 2. P-V characteristics of TCT and MSV for short wide pattern Pattern.

It can be seen from the Figure. 2 the MSV configuration reached a maxim power of 5339 at 165V and TCT achieved a maximum power of 4996 at 165V. Further, we can see that there is an increase of 343 W in outlet power for MSV method compared to TCT configuration. This amounts to 6.46% percentage enhancment, which is quite important. Therefore, we can see in Figure. 2 that the P-V characteristics of MSV are more linear and the Global peak is clearer compared to the that TCT has multiple local peaks. However, adjusting the PV panels according to MSV pattern, improve the power generated from the array. As observed from Figure. 2, in this case of short Narrow the power produced by the MSV configuration is higher compared to TCT configuration as shown clearly in P-V curves Figure. 2.

Conclusions

This paper presents the proposed MSV configuration for the arrangement of PV panels in a PV array, which presents an enhancement in the output power of PV configurations under partially shaded. In this technique, the physical location of the PV modules in the PV array is readjusted according to the MSV pattern without changing the electrical connection. The MSV configuration disperses the concentrated shading over the entire PV modules and decreases the mismatch losses of modules. Thus, ameliorate the generated PV power. The performance of the system is analysed, and it is proved that the proposed technique allows us better results as compared to the TCT schemes.

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