Comparison of Photovoltaics System Response with Constant and Variable Step MPPT Algorithm

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Extended Abstract

The basic foundation for obtaining maximum power is reaching the maximum operating point (Maximum Power Point), which makes it the highest possible power produced by the panel in the given solar and temperature conditions. Achieving this power requires adjusting the voltage in the work cycle, which unfortunately requires a kind of "search" by "sampling" the value of the instantaneous power at a given voltage. However, it takes a certain time to reach the maximum power, which implies power losses. One of the best known and quite simple MPPT algorithms is P&O (Perturb and Observation). Its operation, however, has a certain disadvantage related to the abrupt change of parameters, which in certain situations does not allow to obtain the optimal operating point. The paper compares the results obtained from the model with the P&O algorithm used at a constant and variable step.

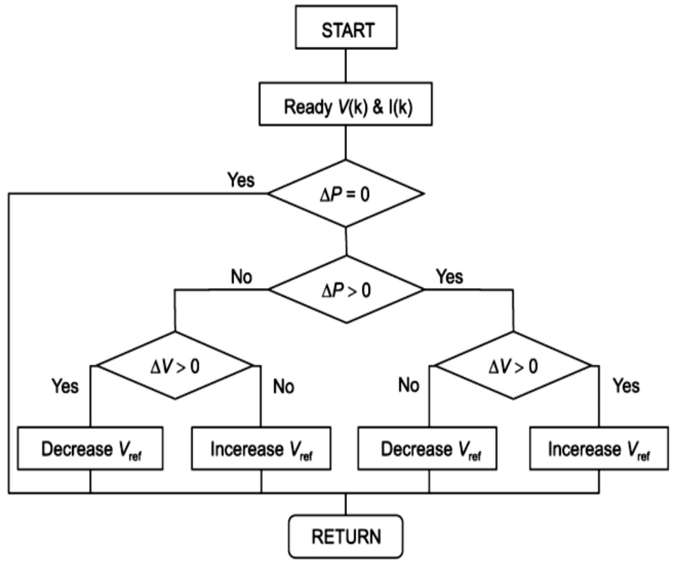

Fig. 1. MPPT algorithm.

MPPT (Maximum Power Point Tracking) is one of the key elements of photovoltaic systems - the controller, which is an electronic "intelligent" DC / DC converter. It optimizes the match between PV panels and the power grid (in the case of an on-grid system). It is essentially the interface between the load and the PV cells - it controls the duty cycle to get the maximum power of the PV cell taking into account environmental conditions such as grid demand.

The analysis of the functionality of the MPPT algorithm is carried out on the basis of the model created in Matlab / SIMULINK.

Fig. 2 show example power plots as a function of time for four levels of irradiance for the applied P&O algorithm (335W panel) with a fixed step (blue) and a variable step (red) for a temperature of 25 ° C. At first glance, you can see that the time to reach the maximum power in the case of the variable step algorithm is much shorter than in the case of the fixed step (in some cases even twice). It can also be noticed that the oscillation amplitude with a variable step is significantly smaller.

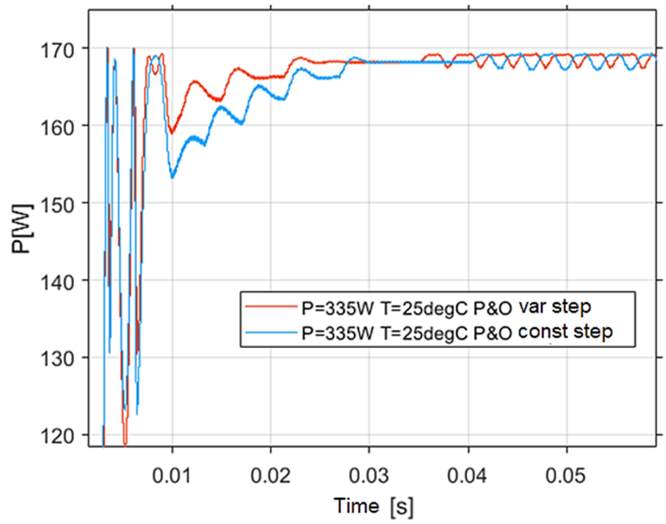

Fig. 2. Characteristics for Ir=500W/m^2.

During the individual levels of irradiance, it was clearly visible that the time courses of the instantaneous power values differ from each other, which is quite interesting - for irradiance 800 W / m^2 for example, the waveforms started to vary depending on the previous level of irradiance. In the case when the previous level of irradiance has a lower value, the upward trend in power is more pronounced and has much smaller oscillations than in the case when the value preceding irradiance is higher.