ABSTRACT

Solar energy is one of the renewable energy sources with significant potential in Indonesia. However, the efficiency of photovoltaic (PV) panels remains relatively low due to the influence of light intensity and temperature variations. This research aims to design and implement a Maximum Power Point Tracking (MPPT) system using a buck-boost DC-DC converter and the Perturb and observe (P&O) algorithm. The study focuses on identifying the Maximum Power Point generated by the photovoltaic panel to improve the overall power conversion efficiency.

The scope of this research is limited to an MPPT system utilizing a 100 Wp solar panel with a buck-boost converter, tested under maximum operating conditions without considering the optimal placement or orientation of the solar panel. The P&O algorithm is employed to optimize the extracted power by adjusting the converter's duty cycle. The power generated by the photovoltaic panel is processed by the system, which is optimized by the MPPT to deliver the desired output.

Experimental results on the buck-boost converter demonstrate that the output voltage can be increased or decreased depending on the applied duty cycle. When the duty cycle is below 50%, the converter operates in buck mode, whereas above 50%, it operates in boost mode. Testing without the MPPT P&O algorithm shows an average efficiency of 65.11%. In contrast, implementing the MPPT P&O algorithm in the system increases the efficiency to 68.89%. Therefore, the application of the P&O algorithm in the MPPT system yields an efficiency improvement of 3.78% compared to the system without MPPT.

Keywords: *Solar Panel, MPPT, Buck boost, Perturb and observe*