

An Enhanced MPPT Method Combining Fractional-Order and Fuzzy Logic PID Controller for a Photovoltaic-Wire Feeder System (PV-WFS)

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Abstract: The use of photovoltaic (PV) module as a power source for wirefeeder systems (WFSs) of arc welding machines is one of the promising domains in the solar PV applications. This paper provides a new kind of welding WFS and investigates the PV penetrated power systems. The considered system consists of a PV module, a DC-DC buck converter, and PMDC motor. The power of the PV-WFS can be widely enhanced by using a Fractional-order Fuzzy PID (FO-Fuzzy-PID) controller based P&O MPPT algorithm. In this work, a FO-Fuzzy-PID controller is also proposed for PMDC motor driven WFS. This will lead consequently to optimize the mechanical motor speed of the WFS. The dynamic response of the PV-WFS relies upon the parameters of these FO-Fuzzy-PID controllers, which are optimized by using Particle Swarm Optimization (PSO) algorithm. Simulation results found are satisfactory and prove the stability, accuracy and dynamic response of the synthesized optimized wire feeder regulating system and the proposed intelligent MPPT algorithm.

Keywords : Solar photovoltaic (PV) module, Wire feeder system (WFS), Arc welding machines, DC-DC buck converter, MPPT control, FO-Fuzzy PID controller, Particle Swarm Optimization (PSO) algorithm