Abstract: This paper proposes an improved voltage controller using MultiStart optimization (MS) algorithm based PI (MS-PI) to control the modulation index for stand-alone PV inverter under different load conditions. In this proposed control algorithm (MS-PI), and parameters are automatically tuned to avoid the trial and error procedure in classical PI controller in order to minimize the output voltage error. To do so, the mean square error (MSE) is used as an objective function with the MultiStart algorithm code. MATLAB models (Simulink and Code) for a PV inverter and the proposed control algorithm are developed. In order to get the desired output voltage of the inverter, a statistical evaluation for the proposed controller (MS-PI) is investigated and compared with that one's obtained by particle swarm optimization (PSO) algorithm based PI approach (PSO-PI). Based on the results, the proposed controller has proven that its performance is robust and efficient in terms of total harmonic distortion (THD), regulated voltage amplitude in term of oscillation, and minimum value of mean square error (MSE) as compared to PSO-PI algorithm.