













Fig. 9. Simulation results of MPPT techniques performance for case 2 (with partial shading): (a) P&O algorithm, (b) Beta Method, (c) GWO algorithm, (d) GWO-Beta algorithm. ( $P_{pv}$ : 250W/div;  $v_{pv}$ : 50V/div;  $i_{pv}$ : 3A/div; time 0.5s/div).

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