Title:	Point of Common Coupling Voltage Modulated Direct Power Control of Grid-Tied Photovoltaic Inverter for AC Microgrid Application
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Abstract:

A direct power control (DPC) approach is proposed in this study for a grid-tied photovoltaic (PV) voltage source inverter (VSI) to regulate active and reactive power flow directly in between utility grid and microgrid (MG) by controlling point of common coupling (PCC) voltage. The proposed PCC voltage modulated (PVM) theory-based DPC method (PVMT-DPC) is composed of nonlinear PVM, nonlinear damping, conventional feedforward, and feedback PI controllers. For grid synchronization rather than employing phase-locked-loop (PLL) technology, in this study, direct power calculation of the PCC voltage and current is adopted. Subsequently, at PCC, the computed real and reactive powers are compared with reference powers in order to generate the VSI's control signals using sinusoidal pulse width modulation (SPWM). Because of the absence of the PLL and DPC method adoption, the suggested controller has a faster convergence rate compared to traditional VSI's power controllers. Additionally, it displays nearly zero steady-state power oscillations, which assure that MG's power quality is improved significantly. To validate the proposed PVMT-DPC method's performance, real-time simulations are conducted via real-time digital simulator (RTDS) for a variety of cases. The obtained results demonstrate that using the proposed PVMT-DPC approach, PV VSI can track the reference power within 0.055 s where the output power has low steady-state oscillations and output current has lower total harmonic distortion (THD) of 1.68%.