Title:	Fuzzy Logic-Based Direct Power Control Method for PV Inverter of Grid-Tied AC Microgrid without Phase-Locked Loop
Author(s) Name:	Shameem Ahmad, Saad Mekhilef, Hazlie Mokhlis, Mazaher Karimi, Alireza Pourdaryaei, Tofael Ahmed, Umme Kulsum Jhuma, Suhail Afzal
Contact Email(s):	ahmad.shameem@aiub.edu
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Abstract:

A voltage source inverter (VSI) is the key component of grid-tied AC Microgrid (MG) which requires a fast response, and stable, robust controllers to ensure efficient operation. In this paper, a fuzzy logic controller (FLC)-based direct power control (DPC) method for photovoltaic (PV) VSI was proposed, which was modelled by modulating MG's point of common coupling (PCC) voltage. This paper also introduces a modified grid synchronization method through the direct power calculation of PCC voltage and current, instead of using a conventional phase-locked loop (PLL) system. FLC is used to minimize the errors between the calculated and reference powers to generate the required control signals for the VSI through sinusoidal pulse width modulation (SPWM). The proposed FLC-based DPC (FLDPC) method has shown better tracking performance with less computational time, compared with the conventional MG power control methods, due to the elimination of PLL and the use of a single power control loop. In addition, due to the use of FLC, the proposed FLDPC exhibited negligible steady-state oscillations in the output power of MG's PV-VSI. The proposed FLDPC method performance was validated by conducting real-time simulations through real time digital simulator (RTDS). The results have demonstrated that the proposed FLDPC method has a better reference power tracking time of 0.03 s along with reduction in power ripples and less current total harmonic distortion (THD) of 1.59%.