

Enhancing Microgrid Power Quality with Dual Output Four-Leg Inverter Topology

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Abstract: *This paper presents the design of a four-leg dual output inverter that aims to compensate voltage and power imbalances between a weak utility and a microsource. The inverter offers several advantages, including component-saving topology and improved reactive power support for the system. The inverter operates in equal frequency mode, which allows for optimal utilization of maximum DC bus voltage and minimizes device ratings. It retains the essential features of a conventional system, such as the ability to compensate for unstable or sagged utility voltage and supply three-phase unbalanced loads with balanced and constant voltage. A carrier-based modulation scheme is employed in this system, and the paper includes a detailed study on the maximum achievable modulation index under various working conditions. The results show that the proposed inverter, when combined with the designed control scheme, significantly enhances power quality, serving as an effective and cost-efficient power conditioner using semiconductor devices. The paper concludes by discussing the system control and the design of its controller. The proposed system's operation is validated through MATLAB simulation, providing further evidence of its effectiveness.*

Keywords: Distributed generation (DG), dual-output four leg inverter, carrier-based pulse width modulation, microgrid, power conditioner, power quality

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