

Hybrid Filtering Techniques for Enhanced Power Quality in Grid-Connected Solar PV Systems.

Author

Aysa Siddika Esha

Nadim Reza

Oishi Jyoti

Abstract:

As global electricity demand continues to rise, the integration of efficient renewable energy systems has become increasingly important. This work focuses on the Grid-Connected Solar PV (GCSPV) system, known for its operational simplicity and low maintenance as renewable energy source. But with presence of power electronic devices and non-linear loads in such system introduces harmonics that impair system performance and degrade power quality. To mitigate these effects, different filtering strategies are analyzed under both linear and non-linear load conditions. For non-linear loads, the LCL with Active Shunt Filter achieves the best performance with a Total Harmonic Distortion (THD) of 1.04%, while for linear loads, it reduces THD to 0.87%. A comprehensive model of a 100-kW doublestage three-phase grid-connected solar PV plant is developed in SIMULINK, incorporating a fixed DC link voltage of 600 volts and employing the Perturb and Observe (P&O) method for Maximum Power Point Tracking (MPPT). The findings highlight the effectiveness of hybrid filtering in enhancing power quality and ensuring reliable grid integration of solar PV systems.

2025 IEEE International Conference on Quantum Photonics, Artificial Intelligence, and Networking, QPAIN 2025

Conference Paper2025

EID: 2-s2.0-105019054270

DOI: 10.1109/QPAIN66474.2025.11172217

ISBN:979-8-3315-9695-8