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Design and Dynamic Response of PLL Based Controller in Grid Tied Solar PV System

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Abstract: *A grid-interfaced solar photovoltaic (SPV) topology has recently gained popularity due to its potential to reduce overall losses and installation costs. This paper describes a novel control strategy for grid-connected SPV systems. The proposed controller is a combination of a synthesis control-based phase locked loop (SC-PLL) and a maximum power point tracking (MPPT) algorithm, ensuring maximum power extraction from the SPV array as well as good transient performance for output voltage and current. The design, modelling, and analysis of a single phase grid-interfaced photovoltaic (PV) system feeding a variety of loads is covered in this paper. Phase-locked loop (PLL) circuits are typically used for synchronization and the generation of in-phase and quadrature templates. However, this paper presents an intriguing application of PLLs for load compensation, power quality improvement, and phase and frequency estimation. The simulation results show that the proposed control for a single-stage PV system can effectively extract the maximum power from the PV system while maintaining a stable output signal during the transient condition. The proposed control with voltage source converter (VSC) compensates the harmonics of grid voltage and current under unbalanced load and keeps the THD of the proposed system less than 5%, which is within the IEEE-519 acceptable limit.*

Keywords: Synthesis Control-Based Phase Locked Loop**,** Photovoltaic, Phase Locked Loop, Voltage Source Converter

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