

## Modelling and Simulation of Hysteresis Current Controlled Single-Phase Grid-Connected Inverter

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**Abstract :** In grid-connected renewable energy systems, input power is controlled by AC/DC converter or/and DC/DC converter depending on output voltage of input source. The power is injected to DC-link, and DC-link voltage is regulated by inverter controlling the grid current. Inverter performance is considerable in grid-connected renewable energy systems to meet the utility standards. In this paper, modelling and simulation of hysteresis current controlled single-phase grid-connected inverter that is utilized in renewable energy systems, such as wind and solar systems, are presented. 2 kW single-phase grid-connected inverter is simulated in Simulink and modeled in Matlab-m-file. The grid current synchronization is obtained by phase locked loop (PLL) technique in dq synchronous rotating frame. Although dq-PLL can be easily implemented in three-phase systems, there is difficulty to generate  $\beta$  component of grid voltage in single-phase system because single-phase grid voltage exists. Inverse-Park PLL with low-pass filter is used to generate  $\beta$  component for grid angle determination. As grid current is controlled by constant bandwidth hysteresis current control (HCC) technique, average switching frequency and variation of switching frequency in a fundamental period are considered. 3.56% total harmonic distortion value of grid current is achieved with 0.5 A bandwidth. Average value of switching frequency and total harmonic distortion curves for different hysteresis bandwidth are obtained from model in m-file. Average switching frequency is 25.6 kHz while switching frequency varies between 14 kHz-38 kHz in a fundamental period. The average and maximum frequency difference should be considered for selection of solid state switching device, and designing driver circuit. Steady-state and dynamic response performances of the inverter depending on the input power are presented with waveforms. The control algorithm regulates the DC-link voltage by adjusting the output power.

**Keywords :** grid-connected inverter, hysteresis current control, inverter modelling, single-phase inverter

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