Single phase pwm inverter

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The Half-Bridge Converter block and the Full-Bridge converter block are modeling simplified model of an IGBT/Diode pair where the forward voltages of the forced-commutated device and diode are ignored.

In order to allow further signal processing, signals displayed on the Scope block are stored in a variable named ScopeDataForFFT, in structure with time format.

Once the simulation is completed, open the Powergui and select FFT Analysis to display the 0 - 5000 Hz frequency spectrum of signals saved in the ScopeDataForFFT structure. The FFT will be performed on a 2-cycle window starting at t = 0.07 - 2/60 (last 2 cycles of recording). Click on Display and observe the frequency spectrum of last 2 cycles.

The fundamental component of V inverter is displayed above the spectrum window. Compare the magnitude of the fundamental component of the inverter voltage with the theoretical values given in the circuit. Compare also the harmonic contents in the inverter voltage.

The half-bridge inverter generates a bipolar voltage (-200V or +200V). Harmonics occur around the carrier frequency (1620 Hz +- k*60 Hz), with a maximum of 103% at 1620 Hz.

The full-bridge inverter generates a monopolar voltage varying between 0 and +400V for one half cycle and then between 0 and -400V for the next half cycle. For the same DC voltage and modulation index, the fundamental component magnitude is twice the value obtained with the half-bridge. Harmonics generated by the full-bridge are lower and they appear at twice the carrier frequency (maximum of 40% at 2*1620+-60 Hz). As a result, the current obtained with the full-bridge is smoother.

The circuit diagram consists of four distinct IGBTs such that they are connected as the bridge circuit. The input to the circuit is the 220v DC supply from the rectifier unit. The IGBTs are triggered accordingly such that the AC output voltage is obtained at the output. The operation of the circuit is as follows.

As the two cycles continue the positive and the negative voltage is applied at the load and the current direction changes in the two cycles. As the current direction changes the alternative voltage is obtained at the load thus converting DC.

A common control method in power electronics for managing the output voltage of converters, particularly DC/AC inverters, is pulse width modulation (PWM). The basic concept behind PWM is to adjust the output pulse width in order to regulate the average output voltage. With PWM, a fixed DC input voltage source can produce a sinusoidal output waveform with variable frequency and amplitude.

PWM methodologies in inverters provide fine control over the output voltage waveform in VSIs, enabling accurate voltage regulation as well as current regulation. This is vital for numerous applications where precise voltage control is necessary for top performance, including motor drives, renewable energy systems, and uninterruptible power supplies (UPS).

With the usage of PWM, it is also possible to control the output waveform"s harmonic distortions which ultimately leads to improved power quality and lowering system losses. In contrast to the fundamental square-wave modulation techniques, PWM in inverters offers advantages in terms of improved control over output voltage, frequency, and harmonics.

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