**NEXT GENERATION SMART GRIDS**

**PROJECT 1**

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**Part 1:**

1. We are using the Sinusoidal Pulse Width Modulation.
2. After applying the range of the triangular generator from 0 to 1, the input of the Pulse Width Modulation will be -1 to 1.

And the Voltage Levels can be V\_low = 0, V\_high = 1.

1. IBT1\_4 waveform:

* If IGBT1\_4 is associated with a phase or leg of an inverter, its waveform would typically be a PWM-modulated square wave.
* The IGBT conducts during the "ON” state, allowing current to flow to the load.
* During the "OFF" state, the IGBT is non-conductive, and the inverter topology determines the voltage across the load.

IGBT2\_3 waveform:

* Similar to IGBT1\_4, IGBT2\_3 might also have a PWM-modulated square wave waveform.
* It would have its own timing and duty cycle, depending on the specific control strategy and modulation scheme used in the inverter.

**Part 2:**

1. The Benefit of using a Closed-loop controller:

* Improved Stability
* Robustness
* Increased Accuracy
* Disturbance Rejection
* Optimization
* Fault Tolerance

1. The effect of changing the amplitude of the sine wave signal depends on the signal which is used. Some considerations are:

* Signal Strength
* Amplitude Modulation
* Effect on Harmonics
* Control of Power Electronics Systems
* Impact on Control Systems

1. Relational Operator conditions help define the behaviour of the system and are crucial for the control algorithm that governs the operation of the power electronic device.
2. Swapping IGBT1\_4 with IGBT2\_3:

Effect on Model Behavior: Swapping these components could lead to changes in the behaviour of the model, depending on the specific roles of IGBT1\_4 and IGBT2\_3 in the system.

5. The voltage PI controller is responsible for regulating the output voltage of the inverter. It compares the reference voltage (desired output) with the actual output voltage, calculates an error signal, and then adjusts the inverter's control signals (usually the modulation index or duty cycle) to minimize this error.

1. AC Input Voltage (Vac) in the Control Loop:

Including the AC input voltage (Vac) in the control loop is common in applications like grid-tied inverters. The control system adjusts the inverter output to track changes in the AC input voltage, ensuring that the inverter can operate seamlessly within the grid environment.

1. The method used is the Vector Control Technique.
2. Whether this technique is necessary depends on the specific requirements of the application. In power electronics systems, particularly those interfacing with the grid or other AC sources, precise control of the output voltage is often crucial.
3. Overshoot refers to the extent by which a variable exceeds its final steady-state value during a transient response. In the context of DC bus voltage in power electronics, overshoot typically occurs during sudden changes in the system, such as rapid load changes or disturbances.
4. Reducing overshoot in the DC bus voltage can be important for stability and system performance. Here are some general strategies to reduce overshoot:

* Proportional Integral Derivative Control Tuning
* Filtering and Damping
* Feed-Forward Control
* Advanced Control Technique
* Load and System Modeling
* Optimal Control
* Feedback Gain Adjustments
* Anti-Windup Mechanisms

**Part 3:**

The maximum possible AC voltage we can get using A phase full bridge DC/AC inverter with DC bus 360V is: 760V