SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF AUTOMOBILE ENGINEERING

COURSE NAME : 23AUB201 – AUTOMOTIVE ELECTRICAL DRIVES AND CONTROLS

II YEAR / III SEMESTER

Unit 5 – Electric Motor Drives

Topic : Single phase and three phase DC to AC convertors

SINGLE PHASE DC TO AC CONVERTER

❖ Converts DC power into single-phase AC power.

❖ Used in low to medium power applications like residential inverters and small motor drives.

KEY FEATURES

❖ **Topology:** Half-bridge or full-bridge configuration.

❖ **Operation:** Pulse Width Modulation (PWM) is commonly used to synthesize the AC output waveform.

❖ **Waveforms:** Output is a square wave or sinusoidal (after filtering).

❖ **Control:** Frequency and amplitude of the output voltage can be controlled by the modulation index and switching frequency.

COMPONENTS

❖ DC input source.

❖ Switching devices (e.g., MOSFETs or IGBTs).

❖ Control circuit (e.g., PWM controller).

❖ Load (AC appliances or motors).
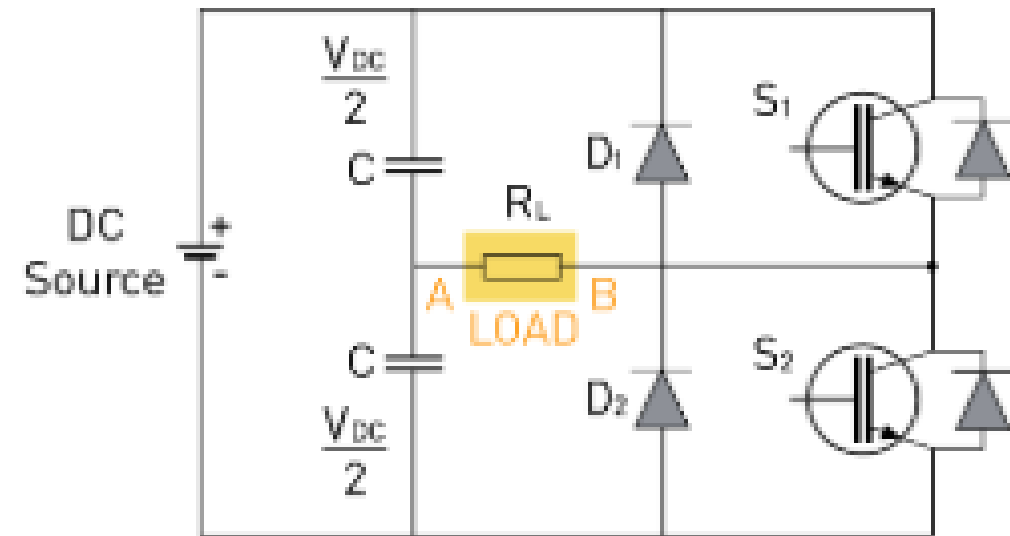
WORKING

❖ A DC source (e.g., a battery or rectified AC) provides a constant input voltage.

❖ In a full-bridge configuration, four switches (S1, S2, S3, and S4) are arranged in pairs.

❖ Switches operate alternately to create a polarity reversal in the output.

❖ A control circuit generates PWM signals to turn the switches on and off.

❖ The duty cycle of PWM controls the output voltage amplitude.

❖ Frequency of PWM determines the frequency of the output AC signal.

❖ Switching produces a square wave AC at the output.

❖ Filters (inductors and capacitors) smoothen the waveform to approximate a sinusoidal AC.

❖ The AC output powers the connected load, such as a single-phase motor or household appliances.

APPLICATIONS

❖ Domestic UPS systems.

❖ Single-phase motors.

THREE PHASE DC TO AC CONVERTER

❖ Converts DC power into three-phase AC power.

❖ Primarily used in industrial and high-power applications such as motor drives, renewable energy systems, and power distribution.

KEY FEATURES

❖ **Topology:** Three-leg bridge inverter.

❖ **Operation:** Space Vector Pulse Width Modulation (SVPWM) or Sinusoidal PWM (SPWM) techniques are used for precise waveform control.

❖ **Waveforms:** Generates balanced three-phase AC waveforms suitable for motors and grid applications.

❖ **Control:** Adjustable output frequency and amplitude for speed and torque control in motor applications.

COMPONENTS

❖ DC input source.

❖ Six switching devices (IGBTs or MOSFETs).

❖ Control circuit (SVPWM or SPWM).

❖ Three-phase load (motors or grid).
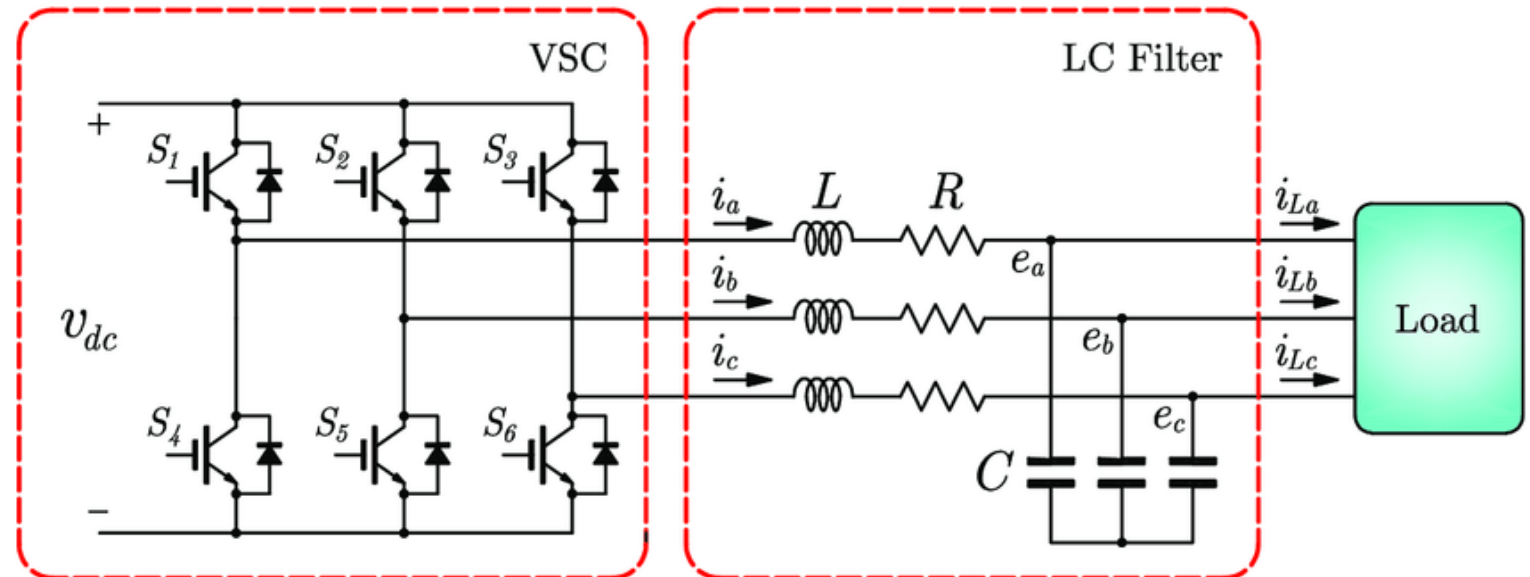
WORKING

❖ A steady DC voltage is supplied from batteries, solar panels, or rectified AC.

❖ Three pairs of switches (S1-S6) form a three-phase bridge inverter.

❖ Each pair controls one phase of the output.

❖ Switches operate in a specific sequence to generate three-phase voltages.

❖ The sequence is controlled to ensure a 120° phase shift between the three phases.

❖ **Sinusoidal PWM (SPWM):** Compares sinusoidal reference signals with a high-frequency triangular carrier wave to determine switch timing.

WORKING

❖ **Space Vector PWM (SVPWM):** Uses vector control for better DC utilization and reduced harmonics.

❖ The bridge generates three sinusoidal AC voltages with a 120° phase shift.

❖ Filters can be added to reduce harmonics.

❖ The AC output powers three-phase loads like industrial motors or connects to the power grid.

APPLICATIONS

❖ Electric vehicle drives.

❖ Industrial motors.

❖ Grid-tied renewable energy systems like solar and wind.

COMPARISON

Feature	Single-Phase Inverter	Three-Phase Inverter
Number of Phases	One	Three
Power Handling	Low to Medium	Medium to High
Complexity	Simpler	More complex
Applications	Residential and small systems	Industrial and high-power systems

THANK YOU !!!