COLLEGE OF ENGINEERING AND TECHNOLOGIES
ALMUSTAQBAL UNIVERSITY

AC Power Converter

EET 307

Lecture 10

- DC to AC Inverter -

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Basic Concept of Resonant Inverter

- The DC - to - AC converter, which is also termed an inverter, converts DC power into AC power at a desired output voltage and frequency.

- The term inverter generally refers to the voltage source rather than current source, that is, it converts energy from a battery or any other fixed DC voltage into AC form whose both magnitude and frequency can be controlled.

Basic Concept of Resonant Inverter

- Thyristor-based inverters are used only in high-power applications.

- For low- and medium-power applications, devices such as
  - The power bipolar junction transistor (BJT).
  - Metal-oxide semiconductor field-effect transistor (MOSFET).
  - Insulated-gate bipolar transistor (IGBT).
  - Gate turn-off (GTO) are used.

Basic Concept of Resonant Inverter

A resonant inverter uses the principle of resonance in an LC circuit.

When an inductor (L) and capacitor (C) are connected together, energy oscillates between them:

- Energy stored in inductor → magnetic field.
- Energy stored in capacitor → electric field.

This oscillation produces alternating current, even if the input is DC.

Basic Block Diagram of a DC–AC Inverter

DC Source (Battery / Rectifier).

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Switching Circuit (SCR / IGBT / MOSFET).

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Control Circuit (Gate Pulse Generator).

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Filter (L or LC).

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AC Output Load.

Blocks Explanation

1. DC Source

- Provides constant DC voltage.
- Examples: battery, solar panel, rectifier output.

2. Switching Devices

- Power semiconductor switches convert DC to alternating waveform.

Devices used:

- Thyristors (SCR)
- MOSFETs
- IGBTs

3. Control Circuit

- Generates gate pulses for switching devices.
- Controls.
- Frequency.
- Output voltage.
- Switching sequence.

Blocks Explanation

4. Filter

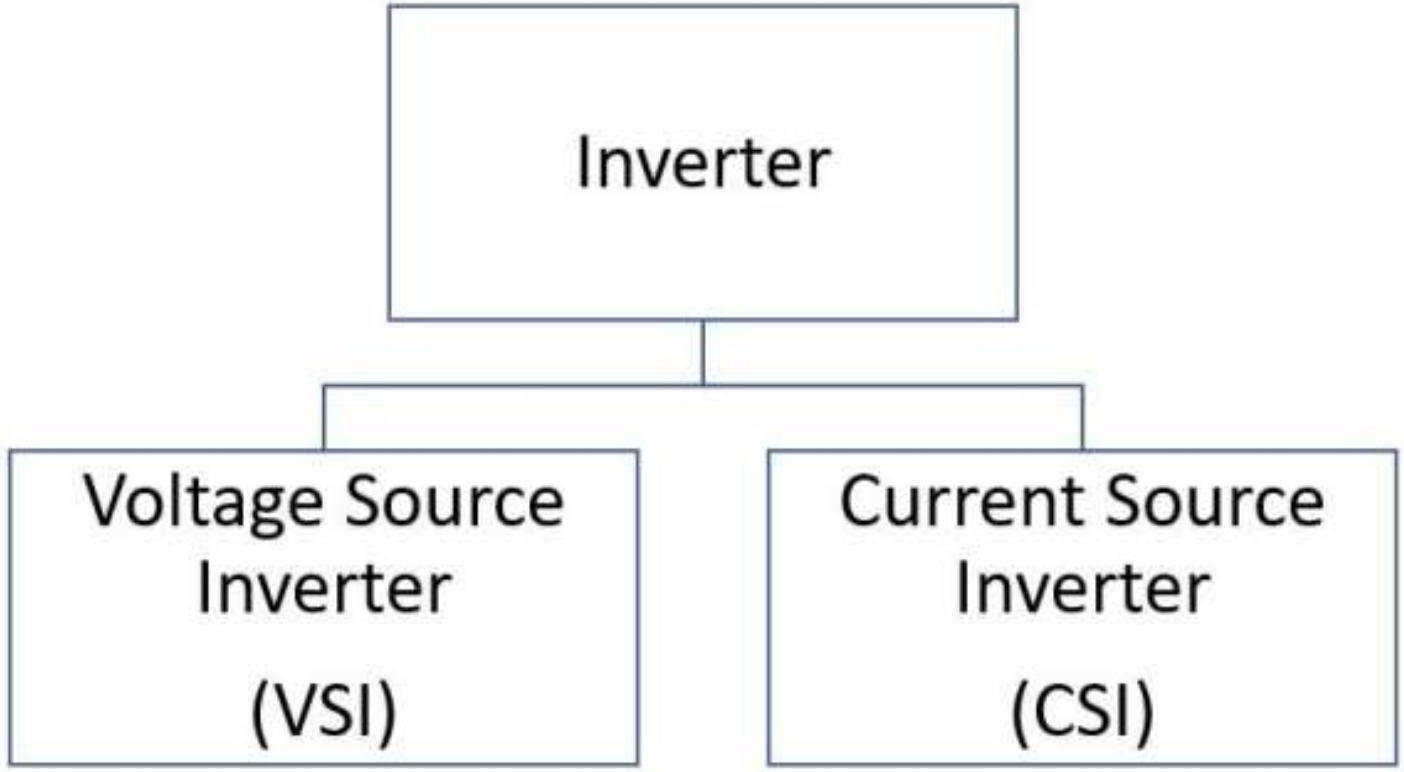
- Removes harmonics.
- Produces smooth sinusoidal AC.

5. AC Load

- Motor, heater, transformer, or power system load.

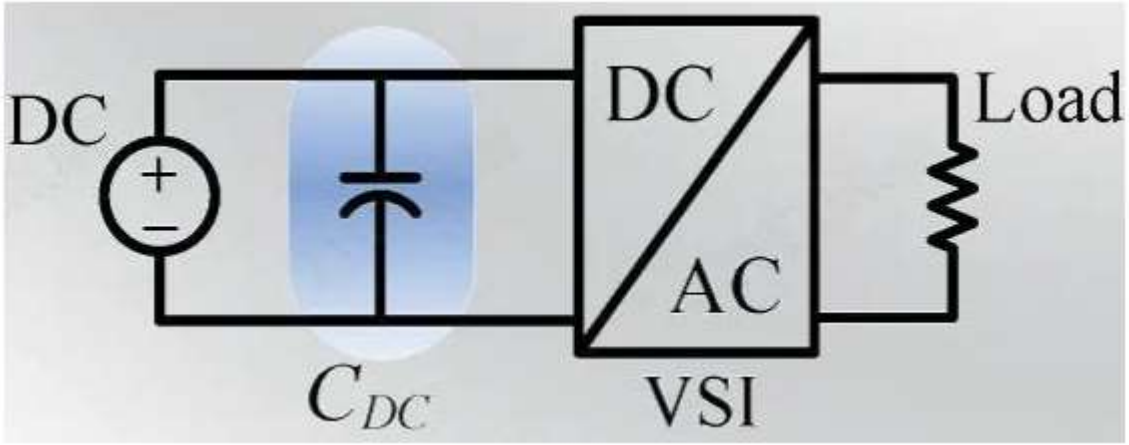
Types of Inverters

There are two types of inverters



Voltage Source Inverter (VSI)

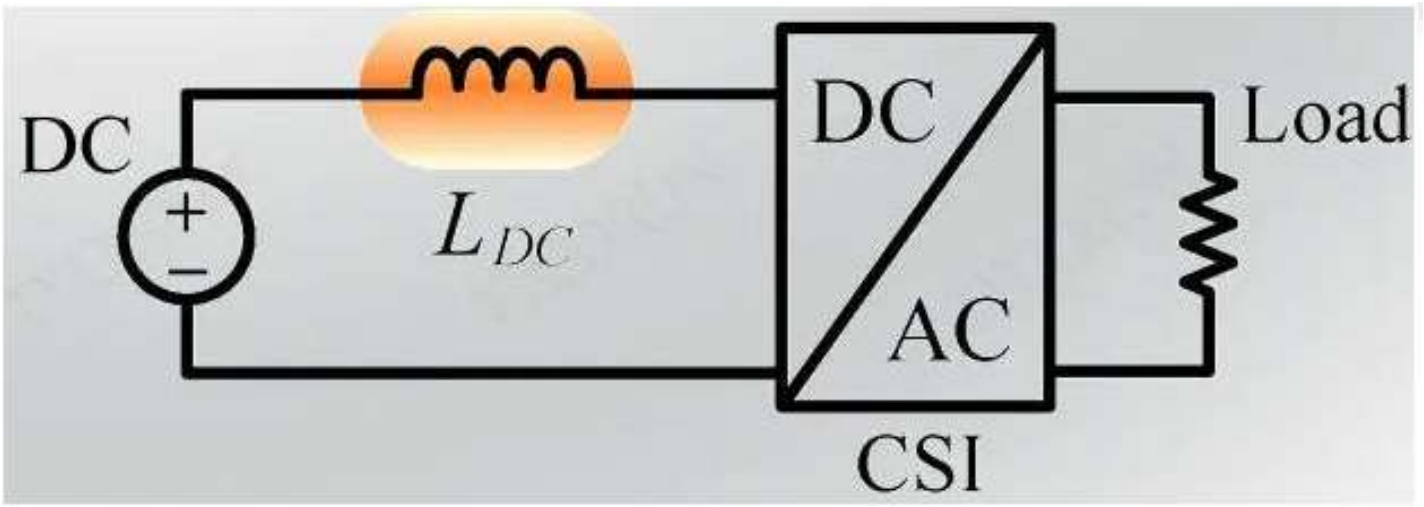
- The DC supply voltage is fixed.
- The supply has low impedance.
- The inverter specifies the load voltage while the current shape is dictated by the load.



Current Source Inverter (CSI)

- The DC supply voltage is varied to control the magnitude of load current.

- Large series impedance is connected in series with the supply to prevent sudden changes in current.



Types of DC–AC Inverters

1. Half Bridge Inverter

- Uses 2 switches.

2. Full Bridge Inverter

- Uses 4 switches and produces higher output voltage.

Types of DC–AC Inverters

3. Series Resonant Inverter

- Uses LC resonance for natural commutation.

4. Parallel Resonant Inverter

- Inductor and capacitor connected in parallel.

5. PWM Inverter

- Uses Pulse Width Modulation to generate sinusoidal output.