COLLEGE OF ENGINEERING AND TECHNOLOGIES
ALMUSTAQBAL UNIVERSITY

# AC Power Converter

## EET 307

## Lecture 11

## - Bridge Inverter -

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# Performance Parameters of Inverters



- Ideally, an inverter should give a sinusoidal voltage at its output.
- But the output of practical inverters is non-sinusoidal and contains harmonics.
- The quality of an inverter is evaluated in terms of the following performance parameters:

# Performance Parameters of Inverters

1. Harmonic Factor of nth Harmonic (HFn):

A harmonic factor is a measure of the individual harmonic contribution in the output voltage of an inverter.

It is defined as:

$$HF_n = \frac{V_n}{V_1}$$

where

$V_n$ = root mean square (RMS) value of the $n$th harmonic component.

$V_1$ = RMS value of the fundamental component of the output voltage.


## 2. Total Harmonic Distortion (THD):

A total harmonic distortion is a measure of closeness in shape between a waveform and its fundamental component.

It is defined as the ratio of the RMS value of the total harmonic component of the output voltage and the RMS value of the fundamental component, that is,

$$\text{THD} = \frac{\sqrt{\sum_{n=2,3\ldots}^{\infty} V_n^2}}{V_1} = \frac{\sqrt{V_{\text{rms}}^2 - V_1^2}}{V_1}$$

where $V_{\text{rms}}$ is the RMS value of output voltage.

# Half Bridge Inverter



- Power circuit and various waveforms for single phase half-bridge configuration are shown in the figure.

- The output voltage is an alternating voltage waveform of amplitude VS /2 and frequency 1/T Hz.

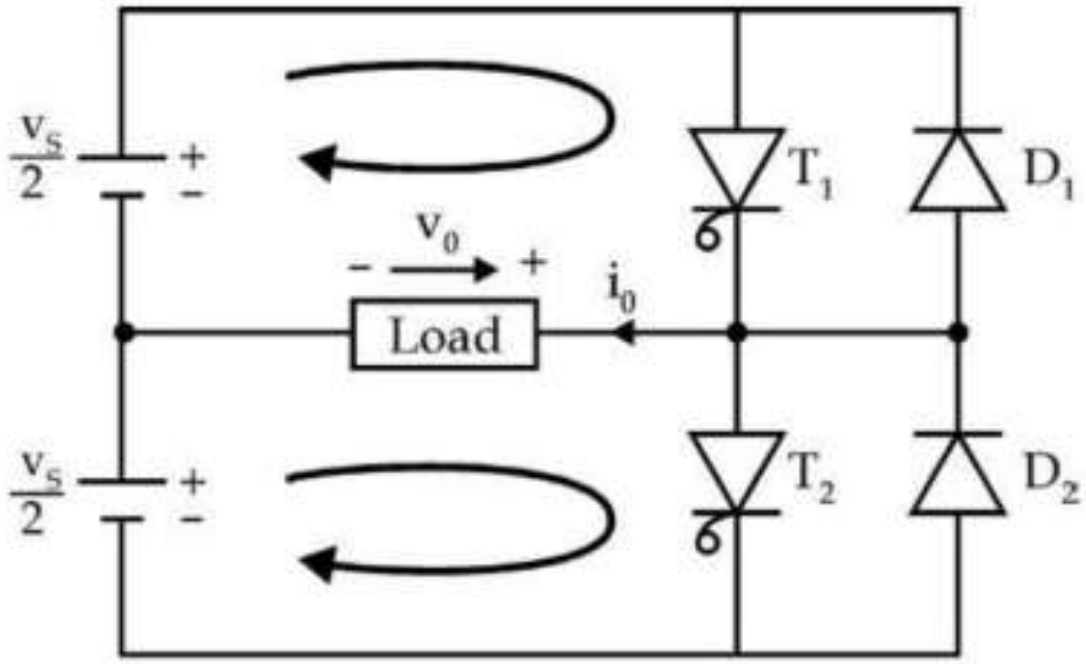
- Frequency of inverter output AC voltage can be changed by varying the periodic time T.

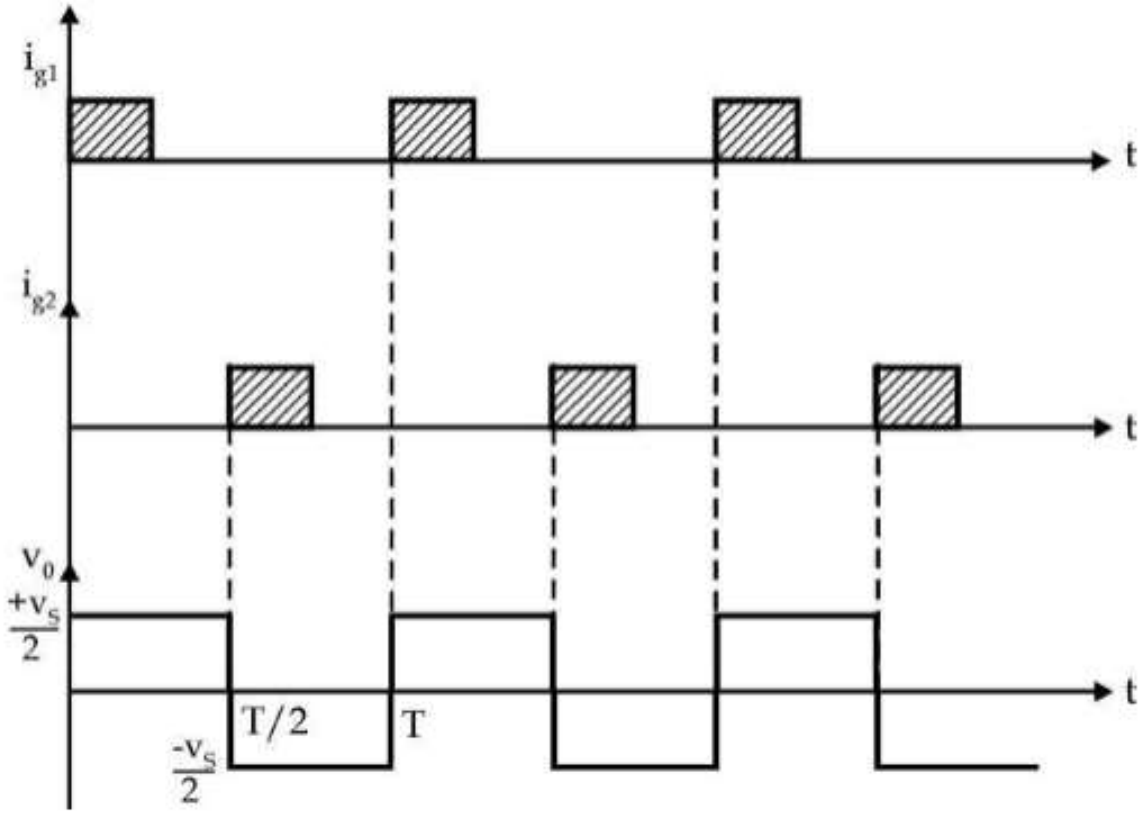
- Demerits (Drawbacks) of half-bridge configuration:

a. It requires a three-wire DC supply.
b. Output voltage magnitude is VS/2 only.

# Half Bridge Inverter





# Full Bridge Inverter

- Power circuit diagram of full-bridge configuration with various waveforms are shown in the figure.

- Frequency of the inverter output AC voltage can be changed by varying the periodic time T.

- Therefore,

$$v_0 = +V_S \text{ and } i_0 = +I_0 \quad \text{for} \quad 0 < t < T/2$$

$$v_0 = -V_S \text{ and } i_0 = -I_0 \quad \text{for} \quad T/2 < t < T$$

# Full Bridge Inverter



## Circuit Description

- DC Source (E): Provides constant input voltage.
- Thyristors ($T_1$–$T_4$): Controlled switches forming the full-bridge.
- Diodes ($D_1$–$D_4$): Provide freewheeling paths for inductive current.
- Load (R–L): Series resistor and inductor.
- Output Voltage (vL): AC voltage across R–L load.
- Load Current (iL): Continuous current due to inductor.

# Full Bridge Inverter



## Operation Principle

### Positive Half Cycle:

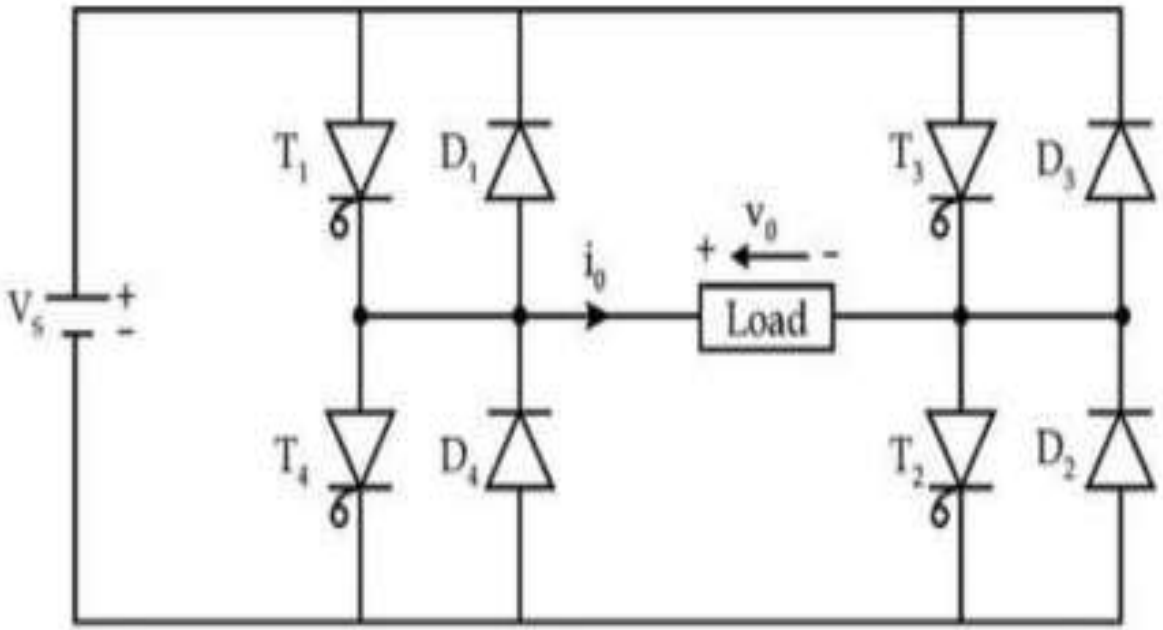
- Trigger $T_1$ and $T_2$.
- Current path: $T_1 \rightarrow$ Load $\rightarrow T_2 \rightarrow$ DC return.
- Diodes $D_1$–$D_4$ allow current to continue through L during SCR turn-off.

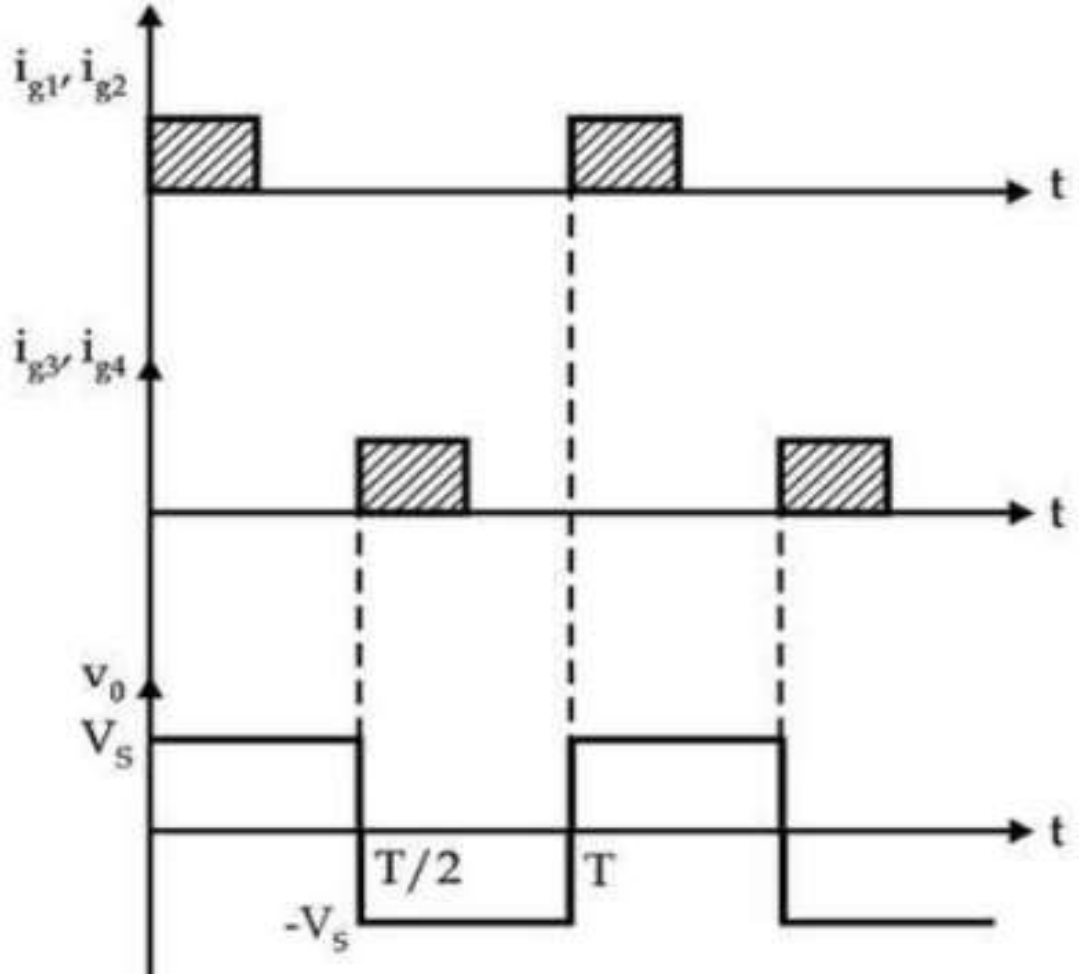
### Negative Half Cycle:

- Trigger $T_3$ and $T_4$.
- Current path: $T_3 \rightarrow$ Load $\rightarrow T_4 \rightarrow$ DC return.
- Freewheeling diodes maintain continuous load current through L.

# Full Bridge Inverter





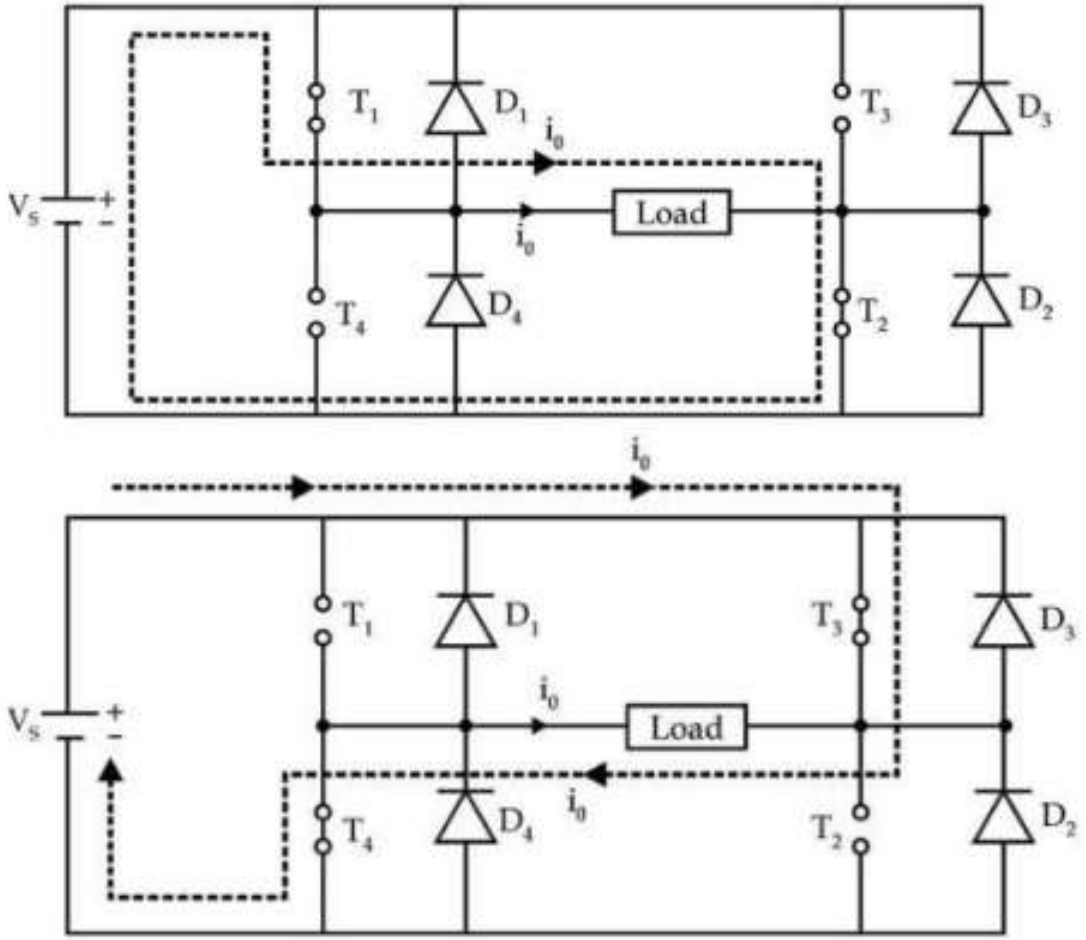

- It should be noted that in VSIs, the load voltage waveforms do not depend on the nature of load, but the load current depends on the nature of load.

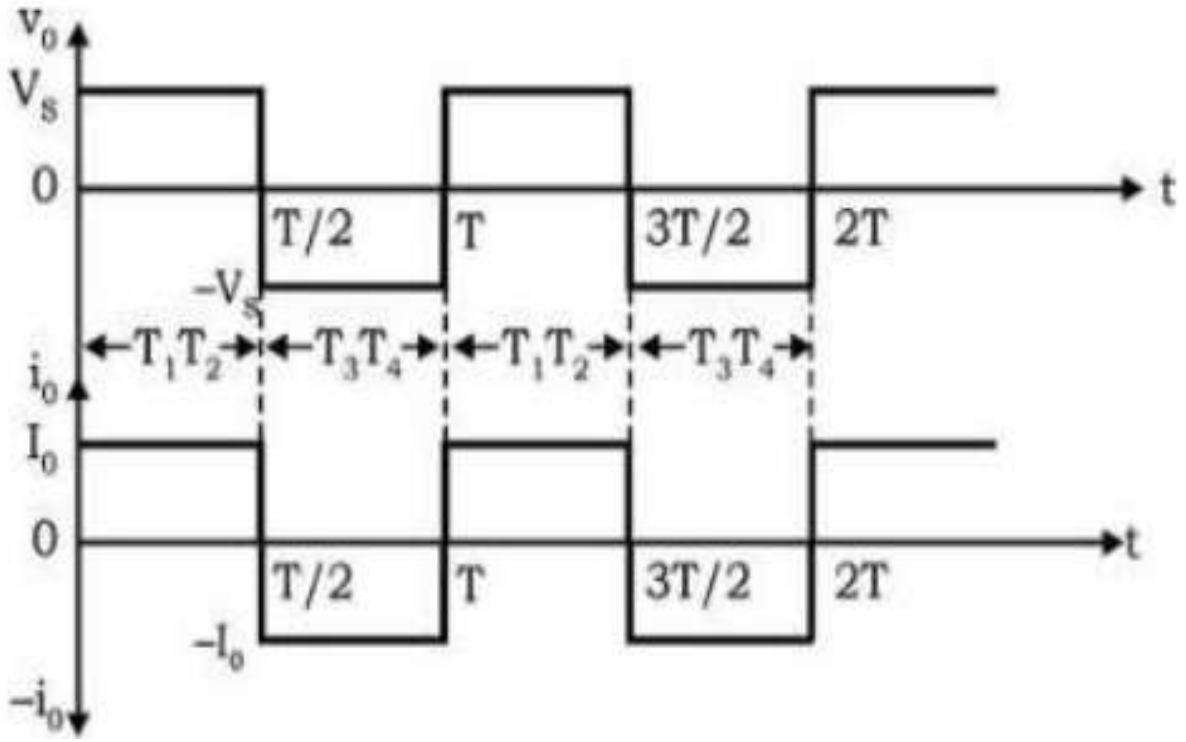
- With R load:

- For resistive load R, load current i0 is identical with load voltage waveform v0 and diodes D1–D4 connected in antiparallel with thyristors (called feedback diodes) are not required.

# Full Bridge Inverter





# Full Bridge Inverter

- With RL and RLC loads

- For inductive loads, load current will not be in phase with voltage vo, and therefore, feedback diodes D1–D4 are required to allow the current to flow when the main thyristors are turned off.

- The load current waveforms for RL and RLC overdamped loads are shown in the Figures.

- Before T = 0, thyristors T3 , T4 are conducting, and therefore load current i0 was -I0.

# Full Bridge Inverter