EXPERIMENT-3

Simulation of a Single-Phase Full-Bridge Inverter (Bipolar PWM) using MATLAB/SIMULINK

OBJECTIVE:

The primary objective of this lab is to gain hands-on experience in simulating a single-phase full-bridge inverter with Unipolar Pulse Width Modulation (PWM) using MATLAB/SIMULINK. The goal is to understand the functioning of power electronic circuits, analyze their performance, and explore the impact of PWM on the inverter output.

EQUIPMENTS:

- MATLAB/SIMULINK software
- Personal Computer

THEORY:

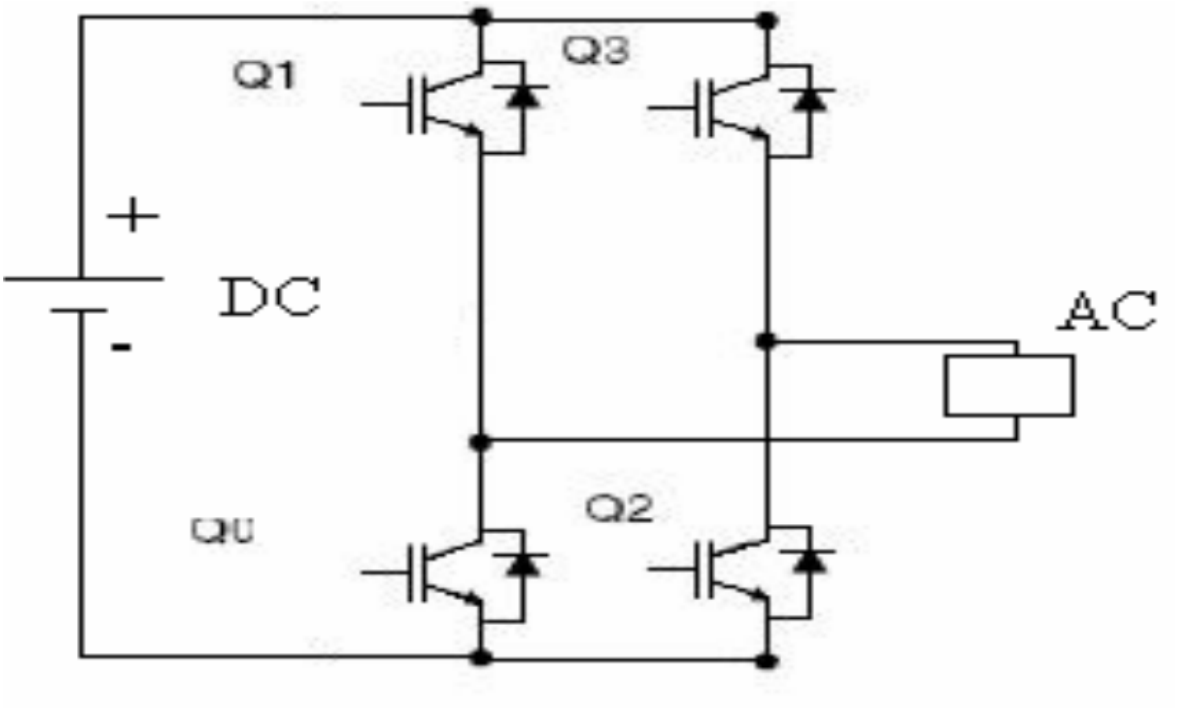
I. Single-Phase Full-Bridge Inverter:

A single-phase full-bridge inverter serves as a crucial component in converting DC power into AC power. Consisting of four switches arranged in a bridge configuration, this inverter facilitates the generation of an AC output waveform by precisely controlling the switching states of the transistors. This configuration enables the inverter to alternate the direction of current flow through the load, effectively producing AC power.

II. Unipolar Pulse Width Modulation (PWM):

Unipolar PWM, a subtype of PWM, operates by comparing a reference signal with a triangular carrier wave to generate the necessary switching signals for the inverter. The duty cycle, which is determined by the width of the pulses generated, plays a critical role in shaping the average output voltage. By adjusting the duty cycle, engineers can finely control the output voltage of the

inverter, allowing for precise regulation and efficient utilization in various applications.



SIMULATIONS STEPS:

- **Open MATLAB/Simulink:**
  - Launch MATLAB on your computer.
  - Open Simulink from the MATLAB toolstrip.

- **Create a New Model:**
  - Start by creating a new Simulink model.
  - Save the model with a relevant name to reflect its purpose.

- **Model the Single-Phase Full-Bridge Inverter:**
  - Utilize Simulink blocks to construct the single-phase full-bridge inverter circuit.
  - Include blocks representing the DC voltage source, switches, and load components.

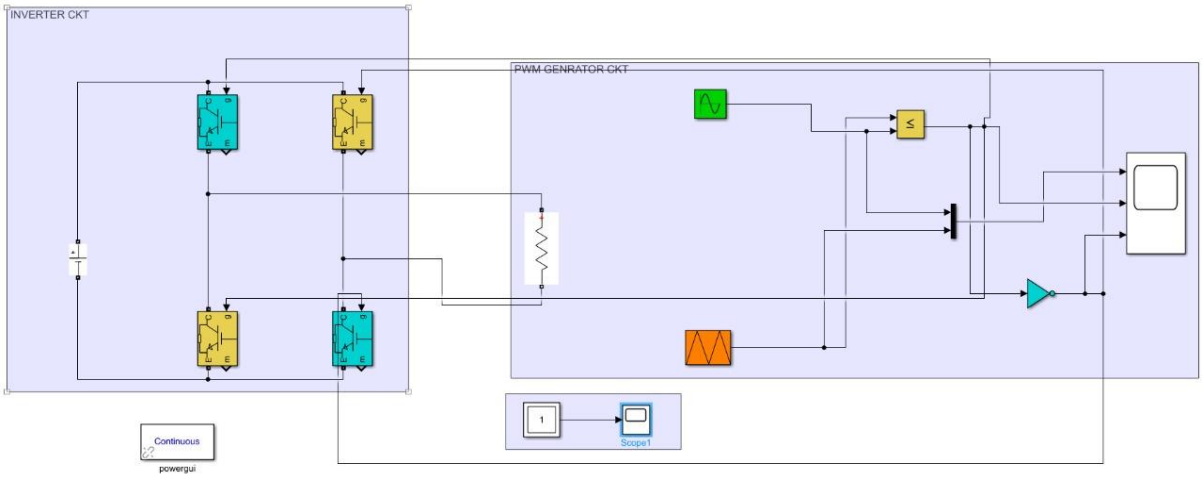
- **Implement Bipolar PWM:**
  - Integrate blocks to generate a triangular carrier wave and the reference signal.
  - Utilize a comparator block to generate the PWM signal based on the comparison between the carrier wave and the reference signal.

- **Simulate the System:**
  - Configure simulation parameters such as simulation time and solver settings.
  - Execute the simulation to observe the inverter's output waveform and PWM signals.

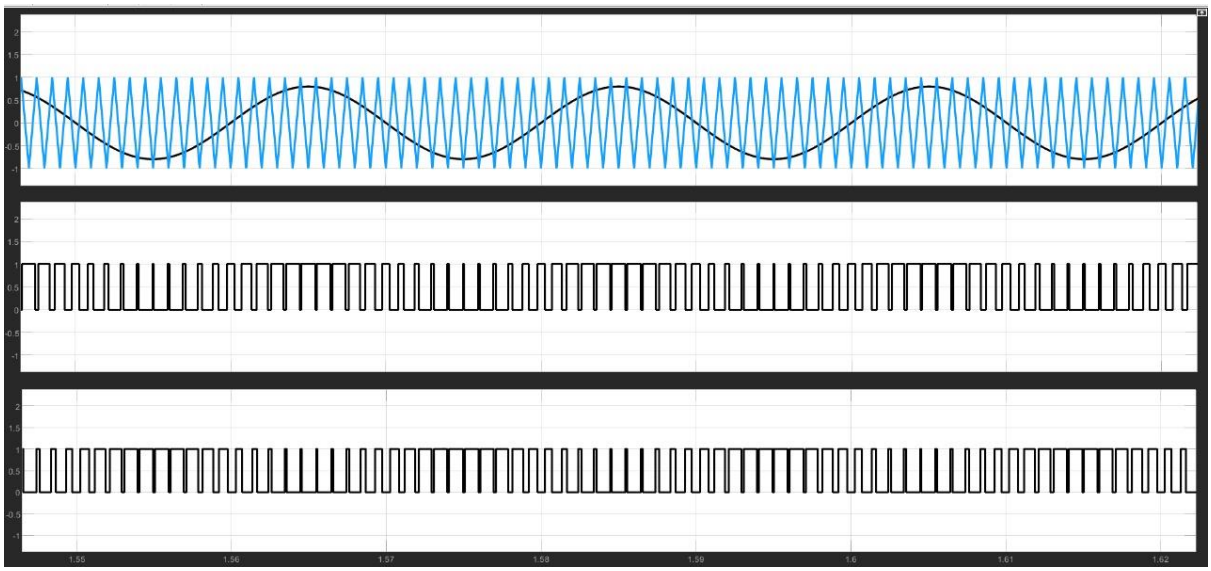
- **Analyze Results:**
  - Analyze the output waveform to observe its characteristics.
  - Observe the effects of parameter changes, such as modulation index and frequency, on the output waveform.
  - Evaluate the impact of PWM on the inverter's output voltage and overall performance.

RESULTS:

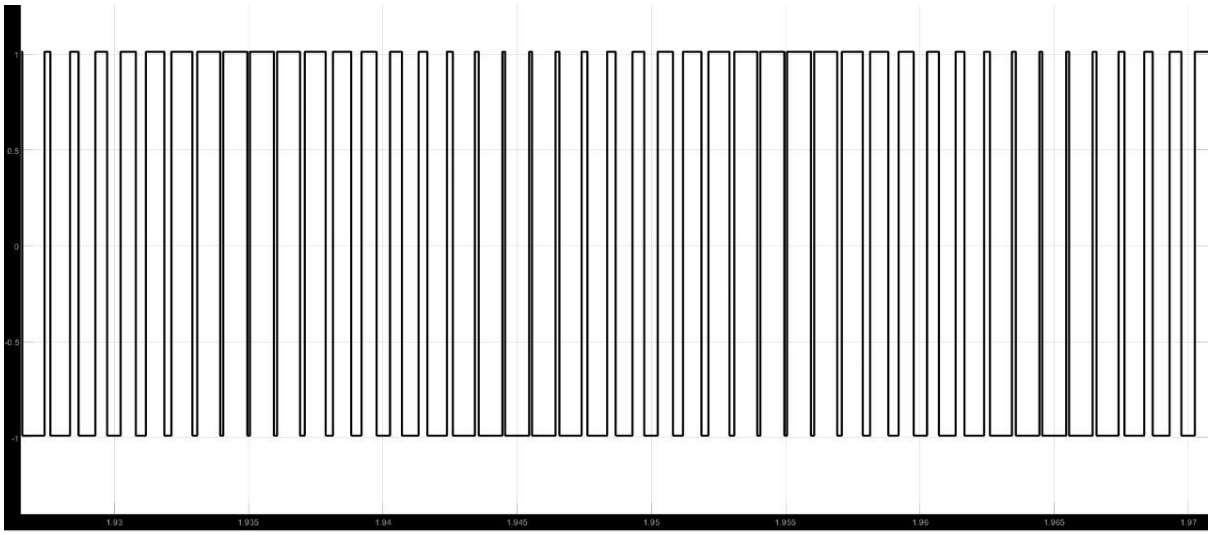
CIRCUIT:



INPUT:



OUTPUT:



PRECAUTIONS:

- Ensure simulation parameters are appropriately set.
- Review model connections and parameters carefully before running the simulation.
- Adhere to safety guidelines for working with power electronic circuits.

CONCLUSION:

This lab provides practical exposure to simulating a single-phase fullbridge inverter with Unipolar PWM using MATLAB/SIMULINK. Understanding the principles of PWM and its influence on inverter output is essential for designing and optimizing power electronic systems.