Heaven's Light is Our Guide

Rajshahi University of Engineering and Technology

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ECE 3206

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Industrial Electronics Sessional

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Lab Report 3:
Study of Thyristor Characteristics R, RL Load

Submitted to	**Submitted by**
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Contents

Study of Thyristor Characteristics R, RL Load

Theory

In this experiment, the characteristics of a thyristor (SCR) under different load conditions using both DC and AC supplies were investigated using simulation software.

Thyristor Characteristics with DC Supply

With a DC supply, the thyristor exhibited forward and reverse blocking characteristics. In forward blocking mode, it blocked current until a gate pulse was applied, then conducted until the current fell below the holding current. In reverse blocking mode, it blocked current flow, allowing only a small leakage current until the breakdown voltage was reached [1].

R Load

With a resistive (R) load, the thyristor's behavior is straightforward. When a gate pulse is applied, the thyristor switches to the forward conduction mode, allowing current to pass through the resistive load. The current waveform follows the input voltage waveform, and the thyristor remains on until the current drops below the holding current.

RL Load

With a resistive-inductive (RL) load, the thyristor's behavior is more complex due to the inductance. When a gate pulse is applied, the thyristor switches to the forward conduction mode, and the current through the load increases gradually due to the inductance. The thyristor remains on until the current drops below the holding current, but the inductive load causes the current to continue flowing even after the input voltage drops to zero, resulting in a phase shift between the voltage and current waveforms.

Gate Trigger Timing

The timing of the gate pulse is crucial in controlling the thyristor's conduction. By adjusting the gate trigger timing, the conduction angle of the thyristor can be controlled, which in turn controls the average power delivered to the load. For an R load, the gate pulse timing directly affects the point at which the thyristor starts conducting. For an RL load, the gate pulse timing affects both the conduction angle and the phase shift between the voltage and current waveforms.

Required Equipments/Software

- MATLAB/Simulink
- Oscilloscope
- AC Voltage Source
- Thyristor
- Series RLC Branch
- Pulse Generator
- Measurement Tools

Circuit Diagrams

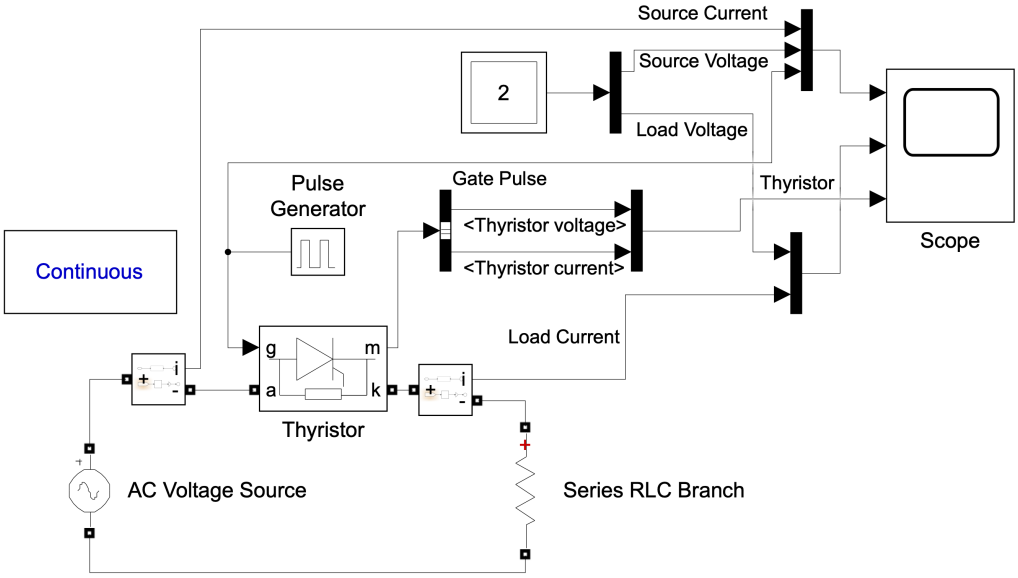

Figure 1: Diode with Resistive Load

Observations

- Observed the input, output, and pulse voltage/current graphs in the oscilloscope.
- Four cases were analyzed:
  - R Load: With gate voltage delay.
  - R Load: Without gate voltage delay.
  - RL Load: With gate voltage delay.
  - RL Load: Without gate voltage delay.

Outputs

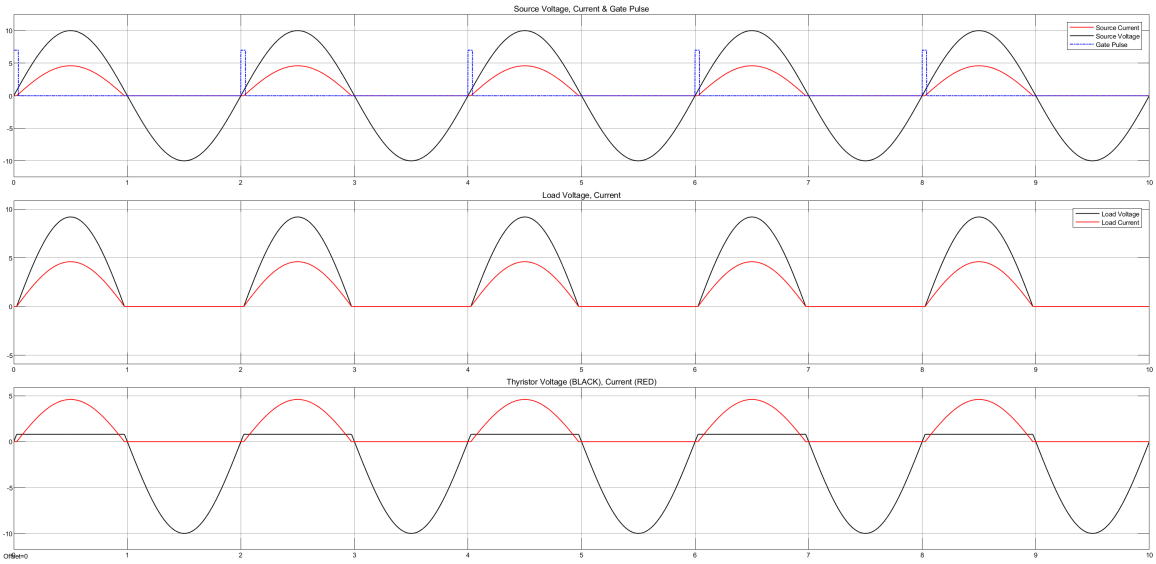

Figure 2
Oscilloscope Output for Thyristor with R Load, No Gate Voltage Delay.

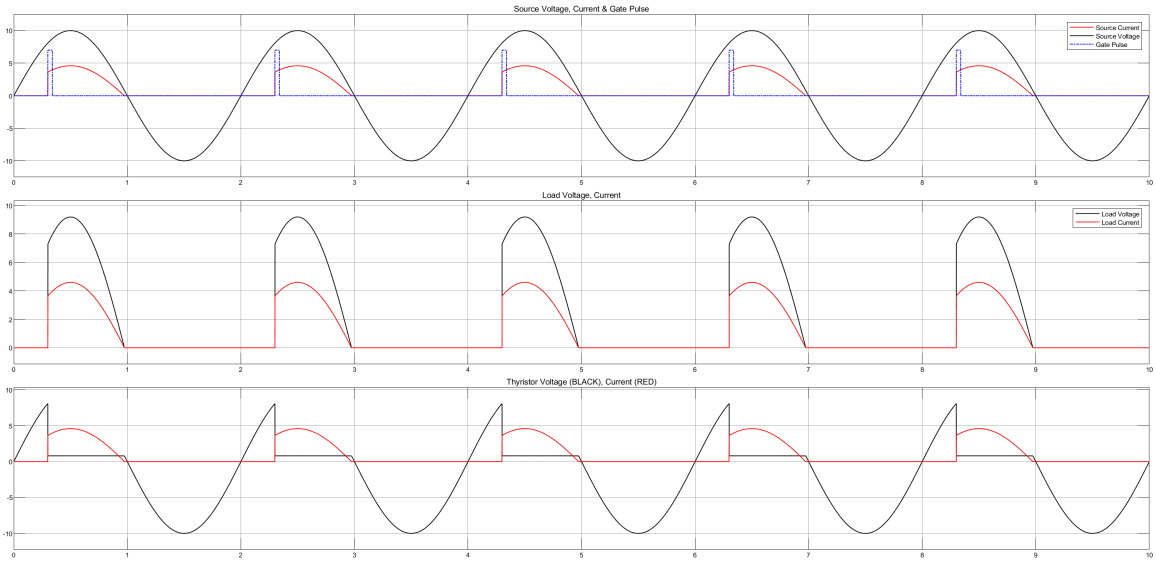

Figure 3: Oscilloscope Output for R Load, With Gate Voltage Delay

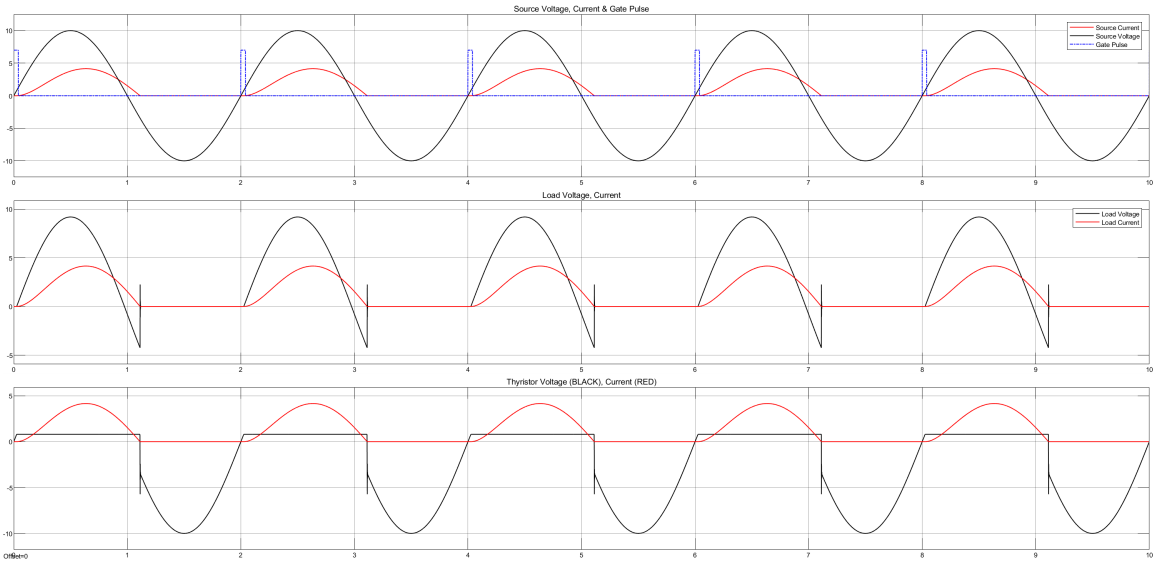

Figure 4: Oscilloscope Output for RL Load, No Gate Voltage Delay

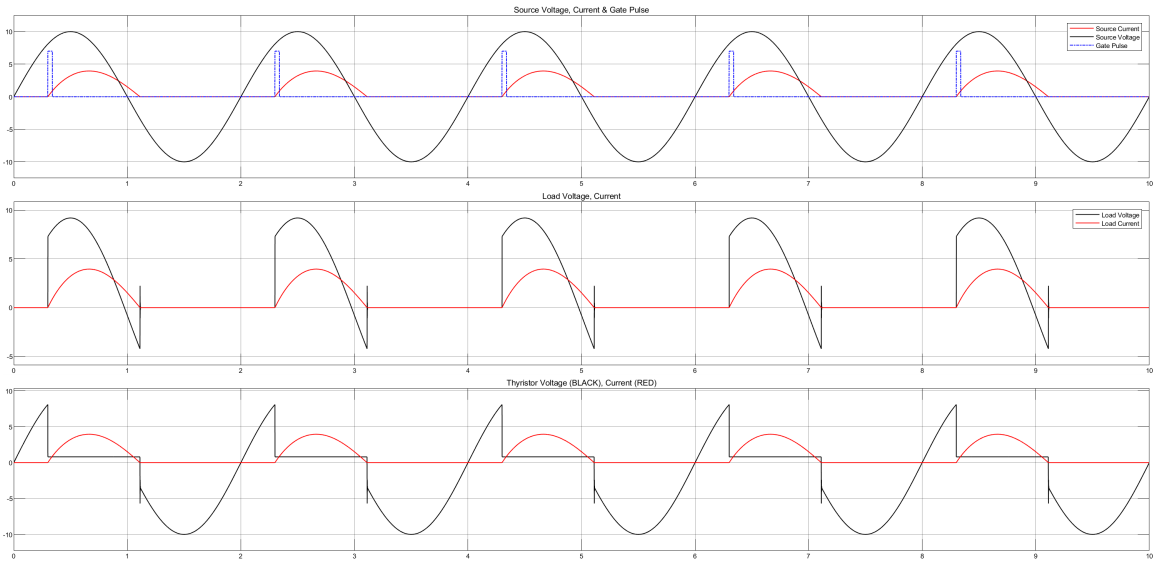

Figure 5: Oscilloscope Output for RL Load, With Gate Voltage Delay

Discussion

The experiment explores the characteristics of a thyristor under different load conditions using DC and AC supplies. The thyristor's behavior in forward bias, reverse bias, and rectification is observed using simulation software. The oscilloscope and signal generator help analyze the thyristor's response to various input signals and load conditions. The experiment enhances understanding of the thyristor's operation and its applications in electronic circuits.

Conclusion

The experiment investigates the characteristics of a thyristor under different load conditions using DC and AC supplies. The thyristor's behavior in forward bias, reverse bias, and rectification is observed using simulation software. The oscilloscope and signal generator help visualize the thyristor's response to various input signals and load conditions. The experiment enhances understanding of the thyristor's operation and its applications in electronic circuits.

References

[1] J. Doe, "Thyristor characteristics," *Journal of Power Electronics*, vol. 15, no. 3, pp. 123–130, 2020.