

Analysis experiment of three-phase bridge full-control rectifier

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Abstract: Through the analysis of the output waveform of the rectifier circuit, this experiment verifies the working principle of the rectifier circuit and the relationship between the input and the output voltage. And observe the waveform when the rectifier circuit fails in the normal rectifier state.

1. Introduction

Use the thyristor to complete the three-phase half-wave rectification. When the trigger angle of the trigger pulse is different, the output waveforms at both ends of the load and the waveform at both ends of the thyristor are different(the same trigger angle, one resistive load experiment and one resistance-inductance load experiment, respectively, observe the waveform). Finally, a trigger pulse is missing and the experimental waveform is observed.

2. Experiments and analysis

2.1 Purpose of the experiment

Be familiar with wiring and control of three-phase bridge full-control rectifier circuit. Master explicit requirements for triggering pulses. Observe and analyze the waveform of the output voltage under resistance load and resistance-inductance load. And also observe and analyze the waveform at both ends of the thyristor.

2.2 Experimental instruments

MCL-III Teaching Experiment Station Main Control Screen, MCL-33 Component and MCL 35 Component, double tracking oscilloscope, avometer, Resistance (light box)

2.3 Experimental principles

The three-phase full-wave rectifier of the thyristor is based on the three-phase full-wave rectifier of the diode and is connected from different places under the action of different trigger angles. That is, the conduction requires two conditions, a forward voltage and a trigger pulse.

2.4 Experimental steps

In the case of circuit resistance load(light box): Adjust Uct(Ug) so that the trigger angle is in the range of 30°- 90°. Use an oscilloscope to observe and record the waveform of the rectifying output voltage and the voltage at both ends of the thyristor when the trigger angles are 30 °, 60 °, and 90 °, respectively. The corresponding voltages are recorded with the avometer.

In the case of a circuit resistance-inductance load: the inductance of 700 mH is strung into the load. Adjust Uct(Ug) so that the trigger angle is in the range of 30 °-90 °. Observe and record the waveforms of the rectifying output voltage and thyristor voltage when the trigger angles are 30 °, 60 °, and 90 °, respectively. Use the avometer to record the corresponding value.

2.4.1 Trigger angle=30°

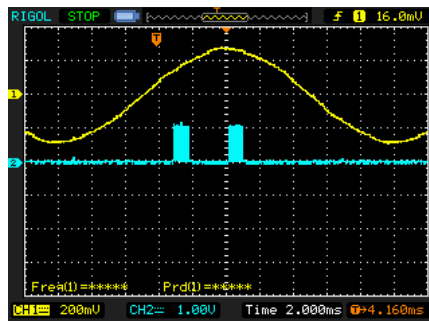


Fig.1 trigger angle=30°

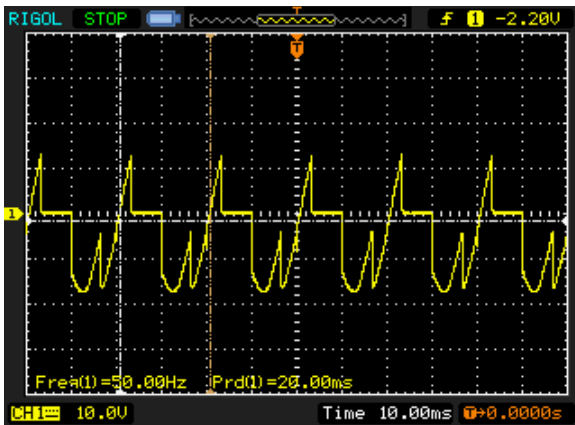


Fig.2 Thyristor Voltage (pure resistive load)

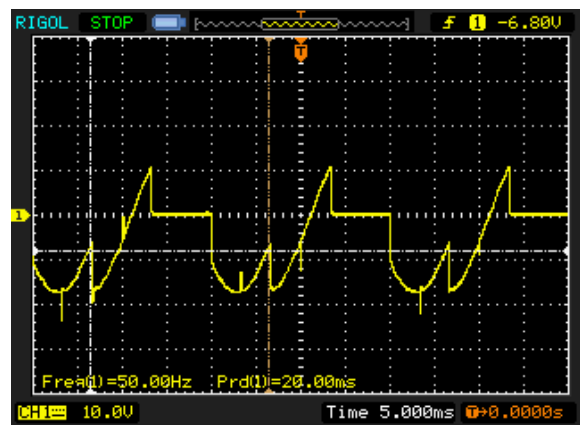


Fig.3 Thyristor Voltage(resistance-inductance load)

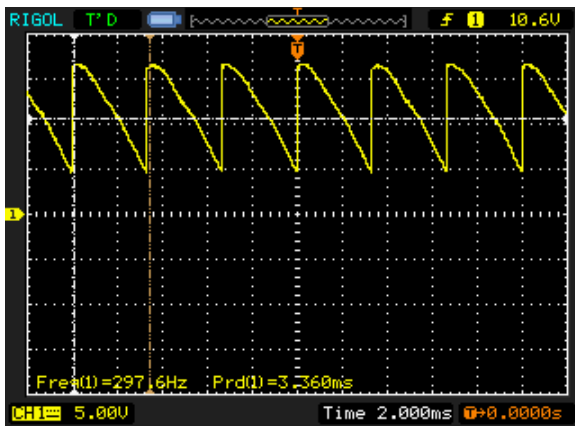


Fig.4 Output voltage (pure resistive load)

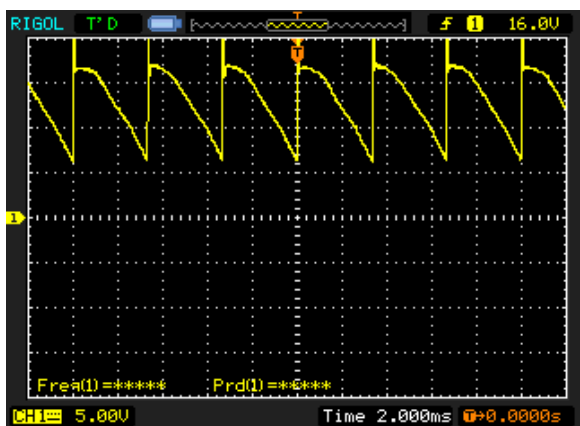


Fig.5 Output voltage(resistance-inductance load)

2.4.2 Trigger angle=60°

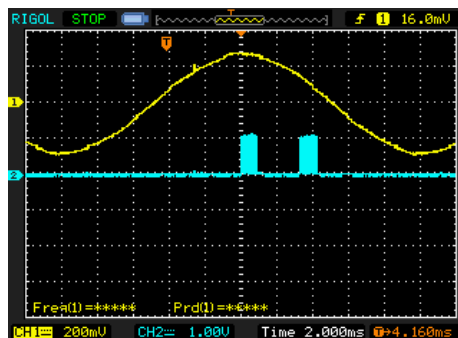


Fig.6 trigger angle=60°

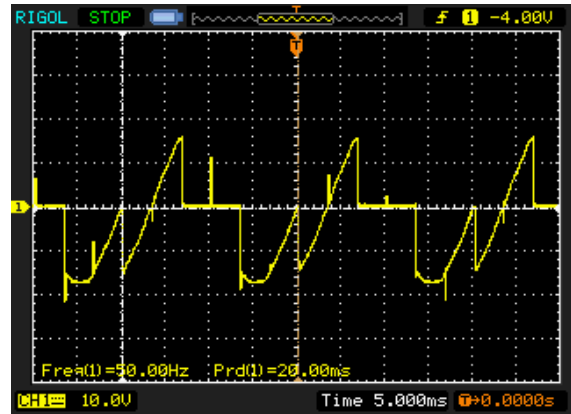
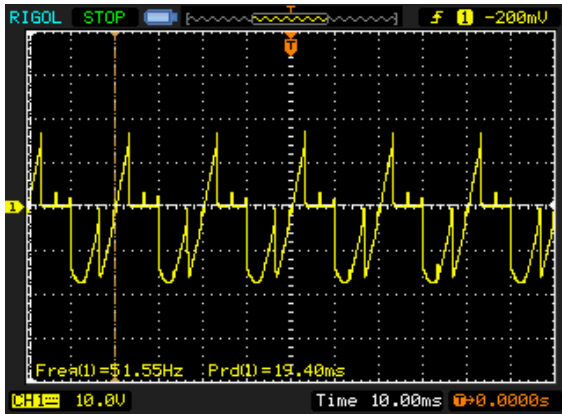


Fig.7 Thyristor Voltage (pure resistive load)

Fig.8 Thyristor Voltage(resistance-inductance load)

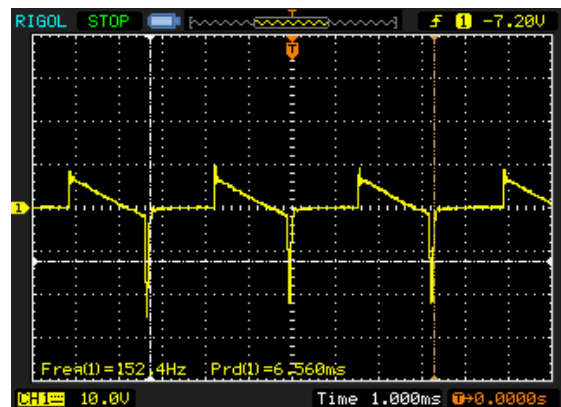
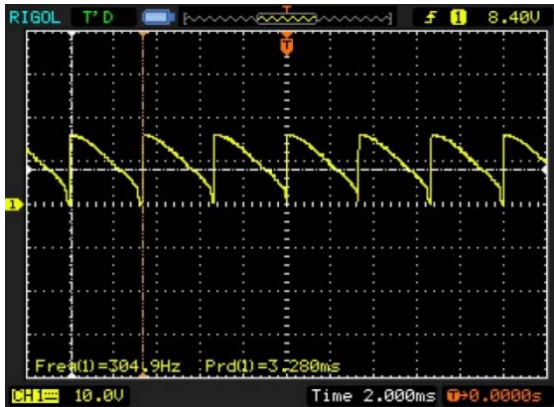


Fig.9 Output voltage (pure resistive load)

Fig.10 Output voltage(resistance-inductance load)

2.4.3 Trigger angle=90°

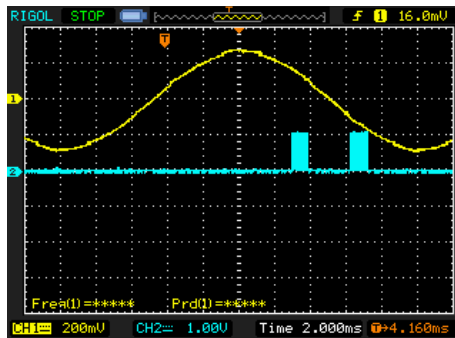


Fig.11 trigger angle=90°

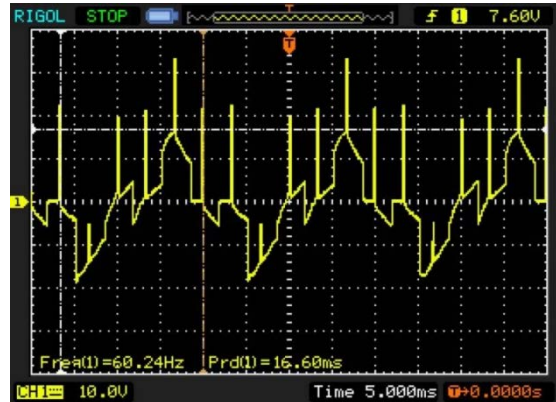
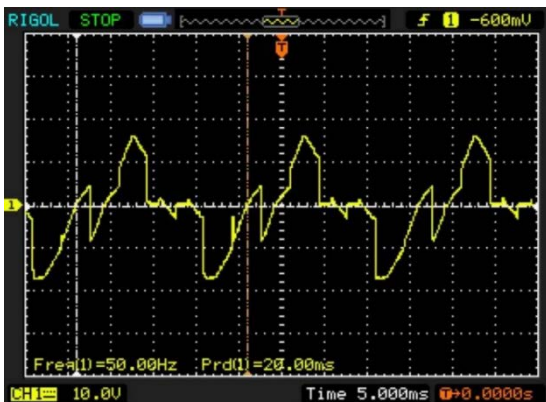


Fig.12 Thyristor Voltage (pure resistive load)

Fig.13 Thyristor Voltage(resistance-inductance load)

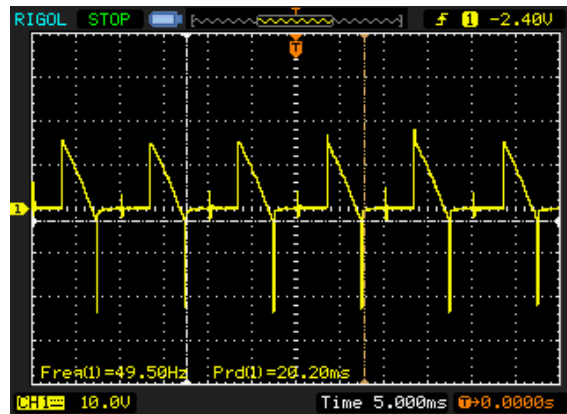
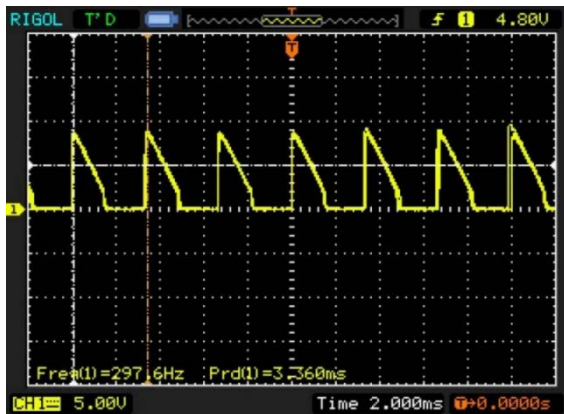


Fig.14 Output voltage(pure resistive load) Fig.15 Output voltage(resistance-inductance load)

2.5 Observation of circuit analog fault phenomenon

Output voltage waveform when VT1 triggers pulse loss (trigger angle=60°):

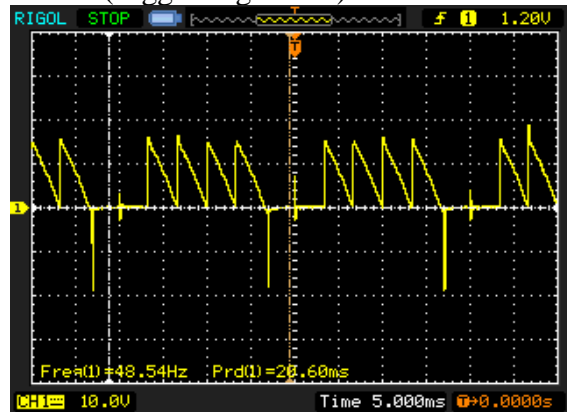
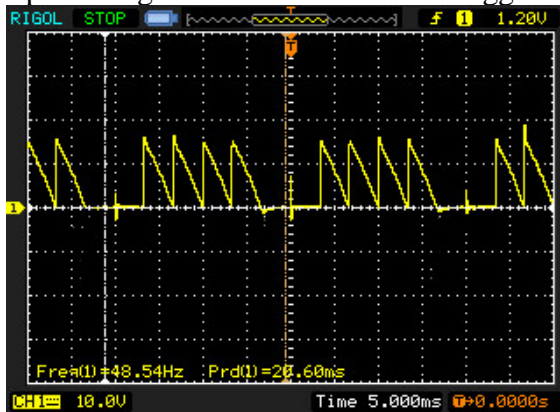


Fig.16 Output voltage (pure resistive load) Fig.17 Output voltage(resistance-inductance load)

3. Conclusion

Through the analysis of this experiment, we master the principle of thyristor rectifier. We understand the influence of the trigger angle adjustment on the output voltage of the load and the output voltage of the thyristor, and study the output voltage in case of thyristor failure. In short, the function of the rectifier circuit is to convert AC power into DC power for DC power supply. It has a wide range of applications and play an important role in DC motors, electroplating, electrolytic power supply, synchronous generator excitation, communication system power supply, etc.. We must be good at using rectifiers and make more research to make contribution to our life and modern development.

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