Resistance Firing Circuit

The resistance triggering circuit is the simplest and most economical circuit. Gate current is simply controlled using the variable resistance and with diode combinations. The load is fed with Ac supply of magnitude 24 volts of 50 Hz frequency. By varying the resistance, the desired condition for firing is obtained for SCR. The diode protects the gate drive circuit from reverse gate voltage during the negative half cycle of the input. And Resistance R1 limits the current flowing through the gate terminal and its value is such that the gate current should not exceed the maximum gate current. However, It suffers from several disadvantages. First, the trigger angle α is greatly dependent on the SCR's Ig(min), which, as we known, can vary widely even among SCRs of a given type and is also highly temperature dependent. In addition, the trigger angle can be varied only up to an approximate value of 90∘ with this circuit. This is because E(s) is maximum at its 90◦.

The circuit of resistive firing circuit is shown below:

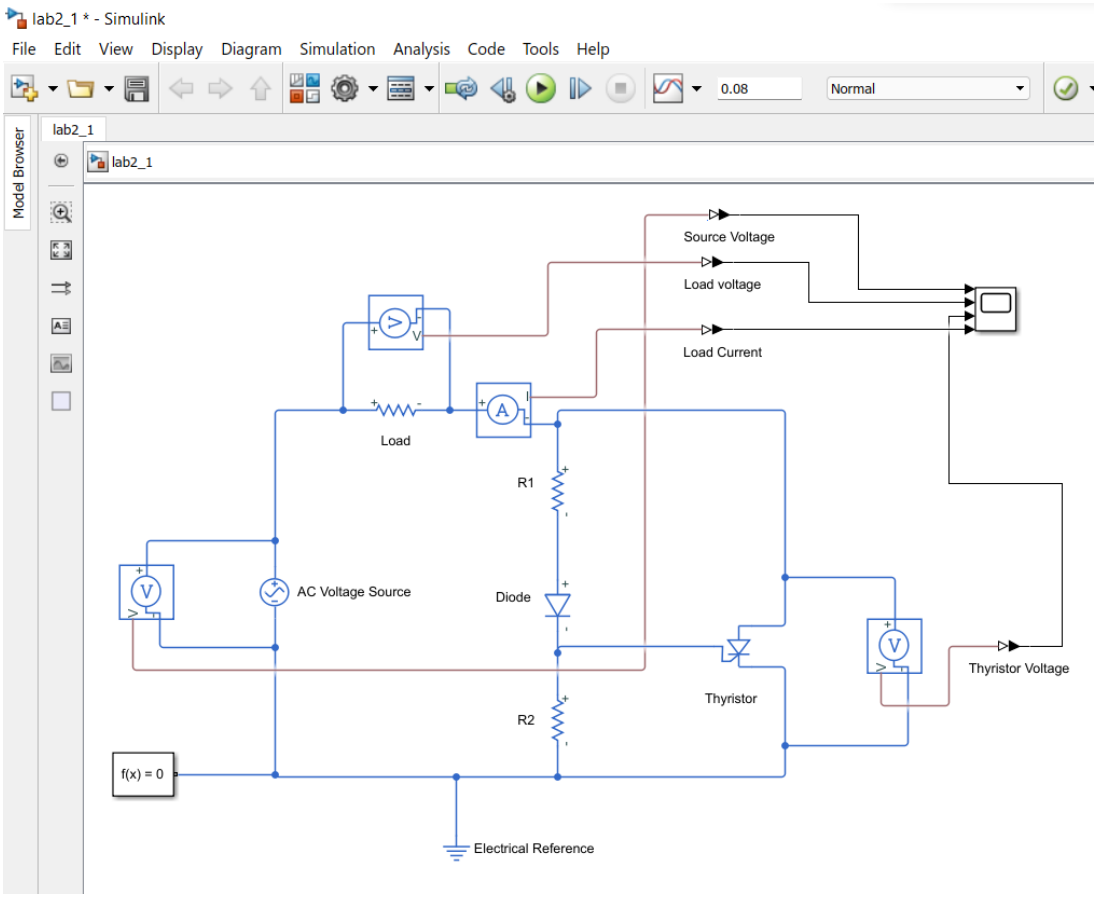
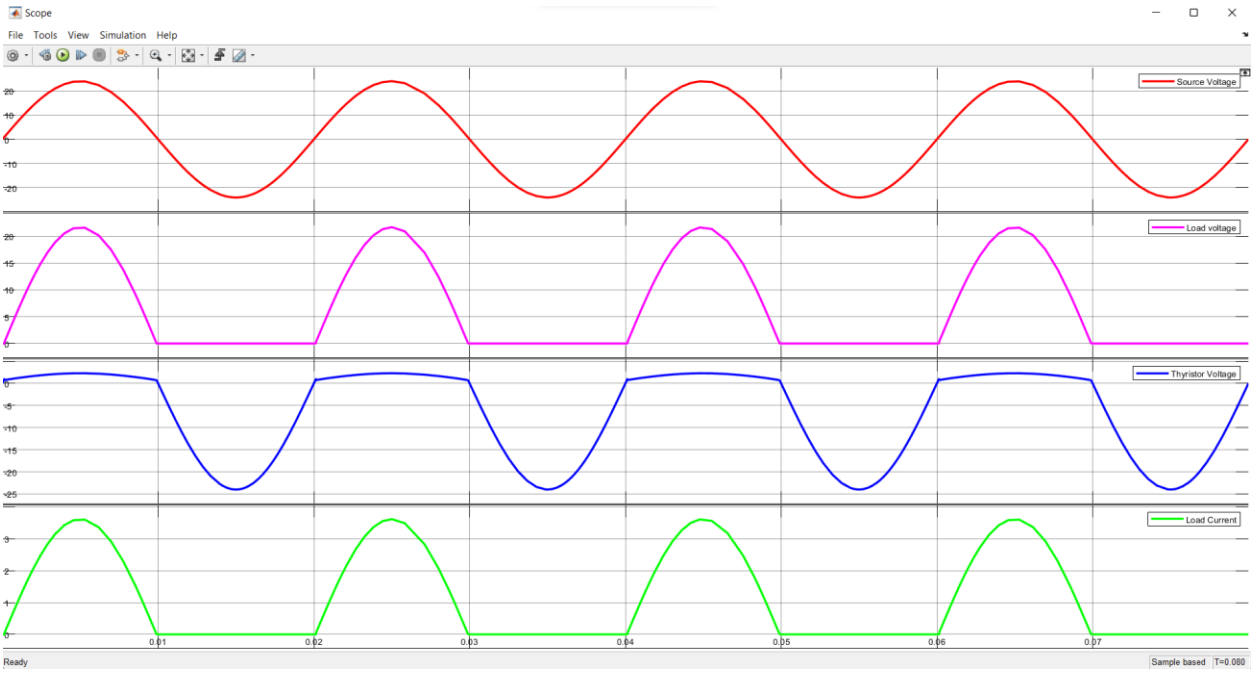


Figure 1:Resistive Firing Circuit

Since, Firing angle is limited from 0^0 to 90^0. It can be obtained by varying the resistance from 1 ohm to 9.2 Kohm.

When R_1= 1 ohm

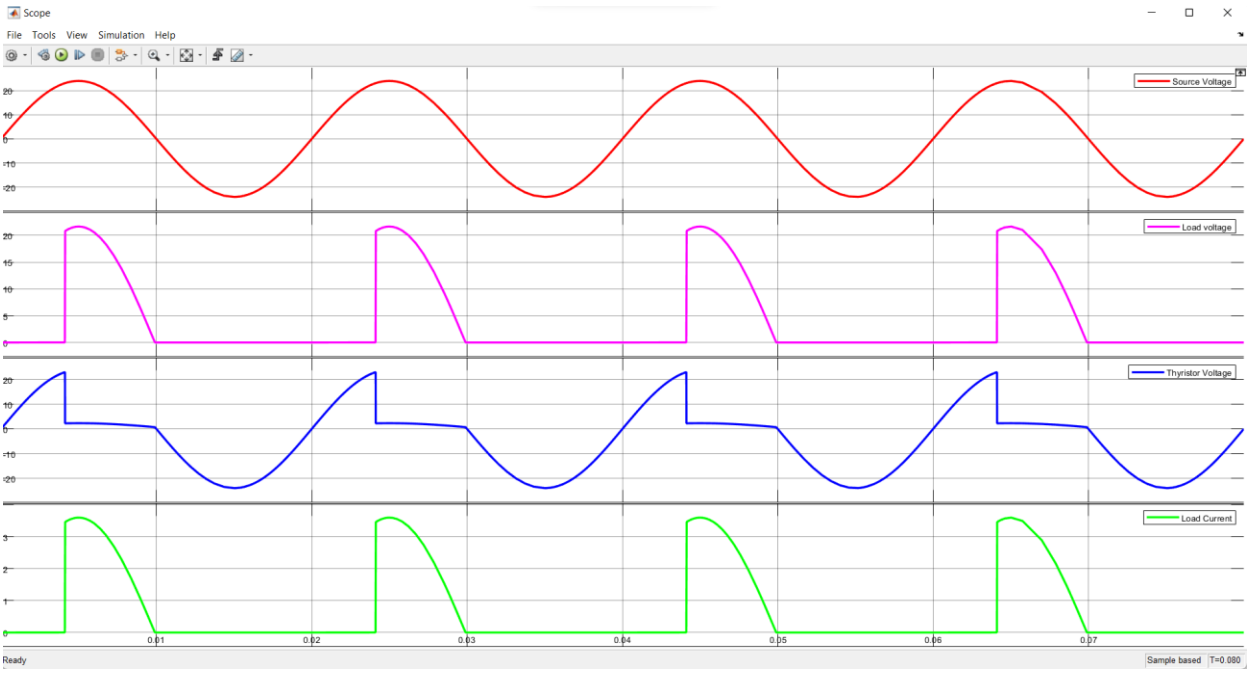
Since gate pulse is given nearly at 0^0, Load voltage is obtained as it as of source voltage. Here, it is resistive circuit so the load current is same as that of load voltage having 0^0 phase degree shift. During the negative half cycle of Ac source, The thyristor is reversed bias acting as open circuit as overall voltage is seen at thyristor.



When R_1= 9.2 Kohm.

During positive half cycle of AC source, the SCR is forward biased and doesn't conduct until its gate current is more than minimum gate current of the SCR. When resistance is varied and 9.2kohm value is set. SCR is forward bias acting as short circuit. The firing angle is set to be nearly at 90^0. The gate current is controlled and voltage appear at load only after approximate 90^0. Here, it is resistive circuit so the load current is same as that of load voltage having 0^0 phase degree shift.

During the negative half cycle of Ac source, the thyristor is reversed bias acting as open circuit as overall voltage is seen at thyristor.



Resistance-Capacitive(RC) Firing Circuit

Capacitive firing circuit is superior over the resistive firing circuit. Gate current is simply controlled using the variable resistance and fixed capacitor and with diode combinations .Similar as resistive circuit, the load is fed with Ac supply of magnitude 24 volts of 50 Hz frequency. By varying the resistance the desired condition for firing is obtained for SCR. And Resistance R1 limits the current flowing through the gate terminal and its value is such that the gate current should not exceed the maximum gate current.

The limitation of resistance firing circuit can be overcome by the RC triggering circuit which provides the firing angle control from 0 to 180 degrees. By changing the phase and amplitude of the gate current, a large variation of firing angle is obtained using this circuit. When the capacitor charging voltage is equal to the gate trigger voltage, SCR is turned ON and the capacitor holds a small voltage. Therefore the capacitor voltage is helpful for triggering the SCR even after 90 degrees of the input waveform. In this, diode D1 prevents the negative voltage between the gate and cathode during the negative half cycle of the input through diode D_2.

The circuit of capacitive firing circuit is shown below:

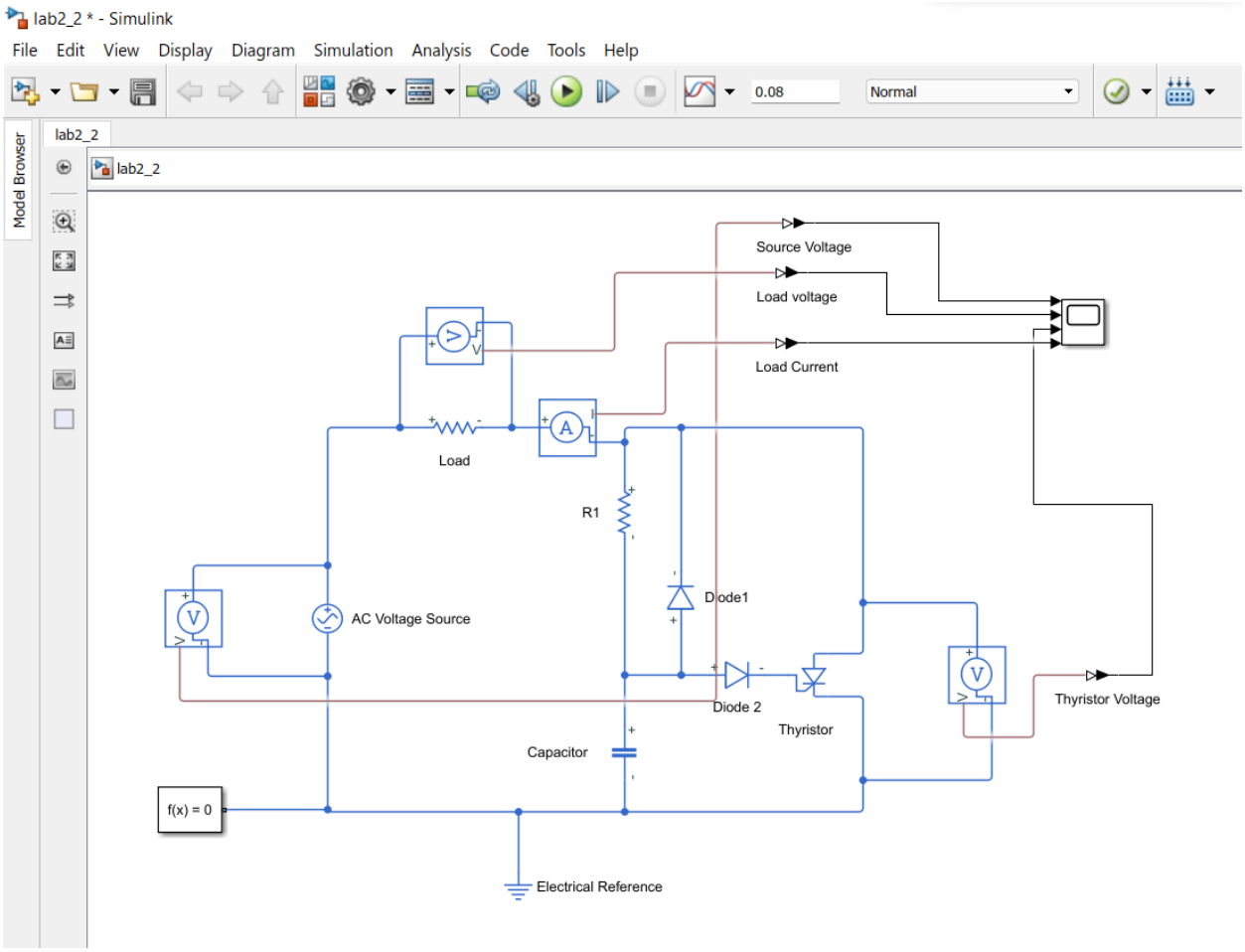
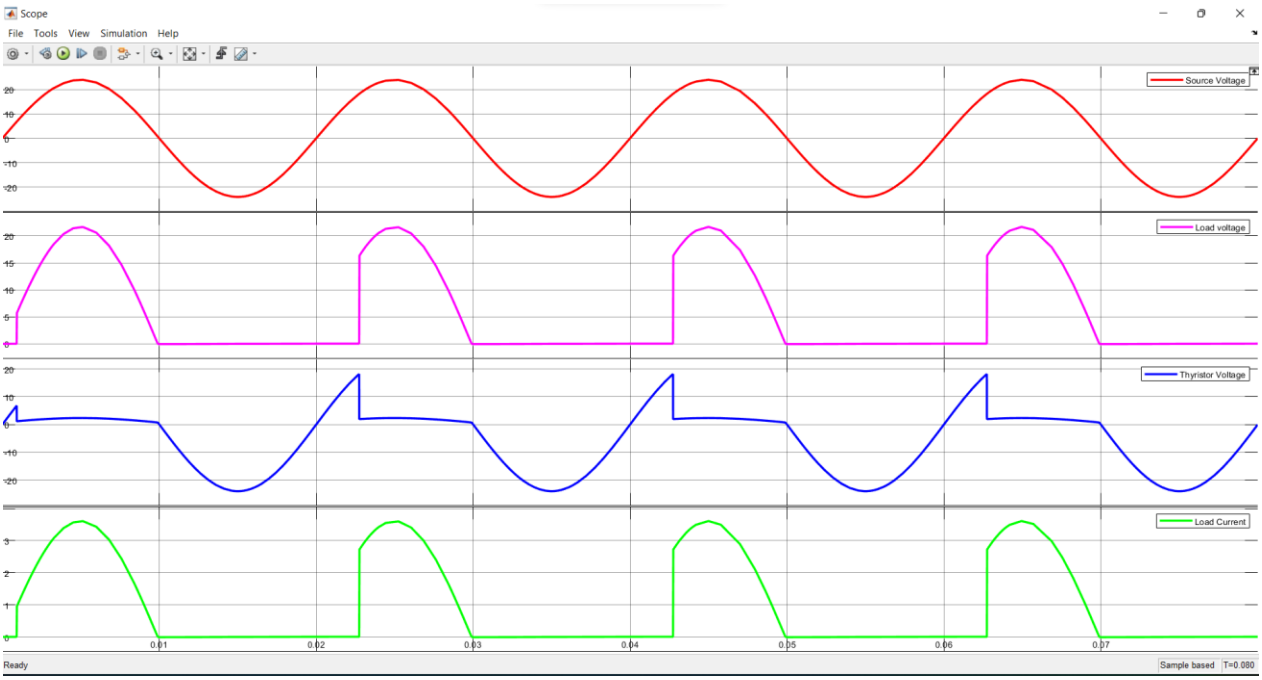


Figure 2: Capacitive Firing Circuit

Here, firing angle can be varied from 0^0 to 180^0. It can be varied by varying the resistance from 1 ohm to 10 kohm.

When R_1= 3 kohm

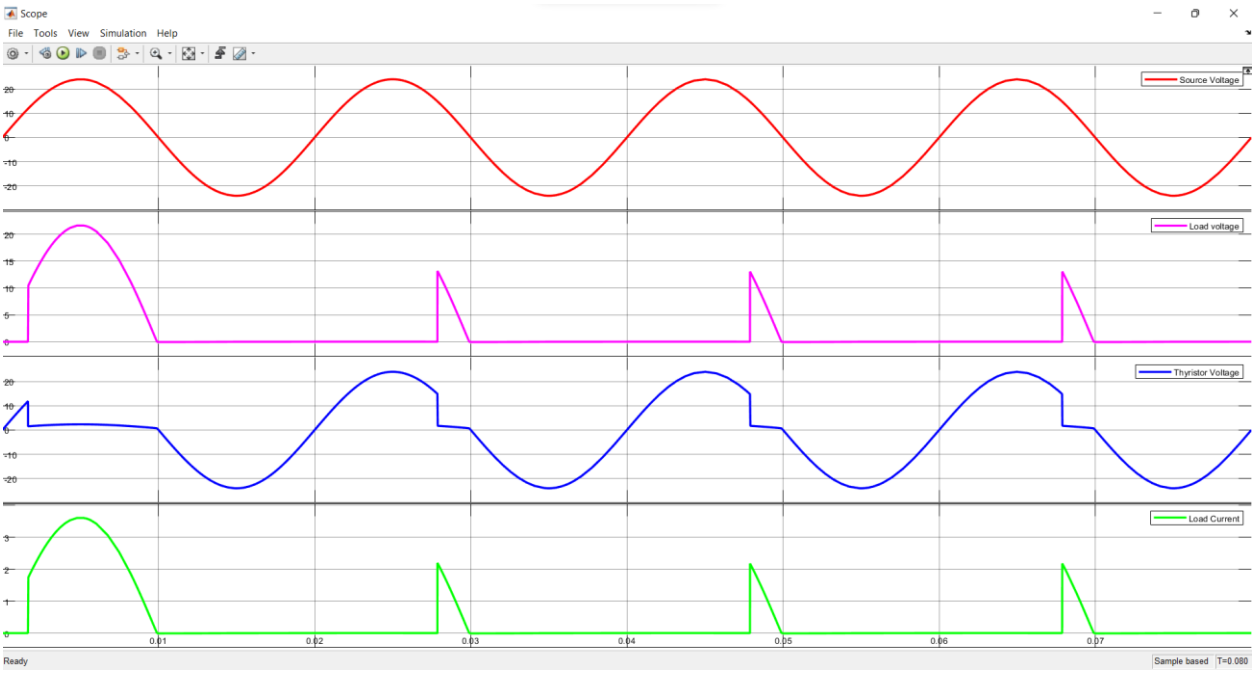
During positive half cycle of Ac source, the SCR is forward biased and doesn't conduct until its gate current is more than minimum gate current of the SCR. When resistance is varied and 3 kohm value is set. SCR is forward bias acting as short circuit. The firing angle is set to be nearly at 60^0. The gate current is controlled and voltage appear at load only after approximate 60^0. Here, it is resistive circuit so the load current is same as that of load voltage having 00 phase degree shift.



During the negative half cycle of Ac source, The thyristor is reversed bias acting as open circuit as overall voltage is seen at thyristor.

When R_1= 10kohm

When Capacitive circuit is fired at resistance value of 10 kohm. During positive half cycle of Ac, the thysistor is forward bias where as it gets only turned on when minimum gate current is supplied. At 10 kohm, it can be observed that minimum gate current has been supplied and voltage appears at load side. The same waveform is obtained of current as voltage waveform.



During the negative half cycle of Ac source, the thyristor is reversed bias acting as open circuit as overall voltage is seen at thyristor.