

Problem Statement - Simulim '22



Deadline of submission: **11 April, 11:59 PM**

Submission link: <https://forms.gle/gYMXZNKsJNeegbK58>

Question 1:

In the two-mesh network shown below, the switch is closed at $t = 0$ and the voltage source is given by $V = 150\sin(1000t)$ Volts. Find the mesh currents i_1 and i_2 as a function of time.

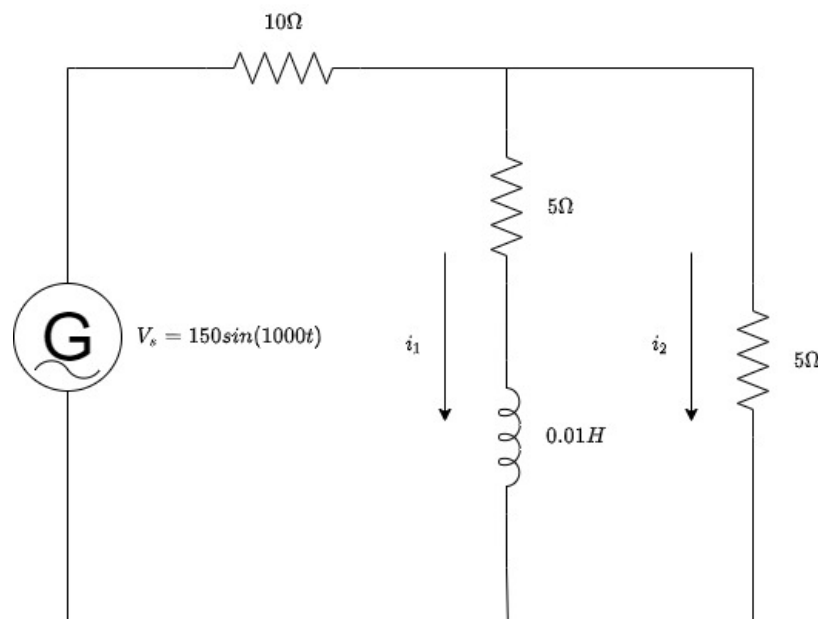


Figure 1

Question 2:

A single-phase full-wave bridge inverter is fed from a $300V$ battery. A Pulse of 120° duration is used to trigger the appropriate devices in each half-cycle. What is:

1. The RMS value of the output voltage for a purely resistive load?

- The RMS value of the output voltage if the circuit has an R-L load with $R = 50\Omega$ and $L = 10mH$.
- The full-wave inverter is shown in **Fig. 2** below with components labeled as in the image. Determine which set of components among $Q_1, Q_2, Q_3, Q_4; D_1, D_2, D_3, D_4$ will be in conduction mode when $V_{out} < 0$ and $I_{out} > 0$.

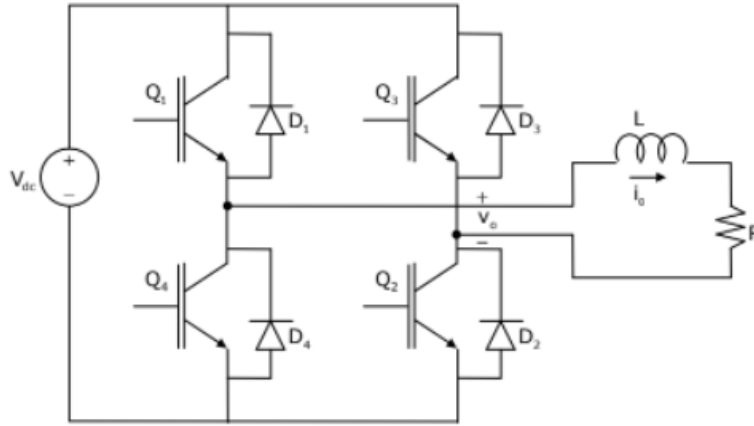


Figure 2

Question 3:

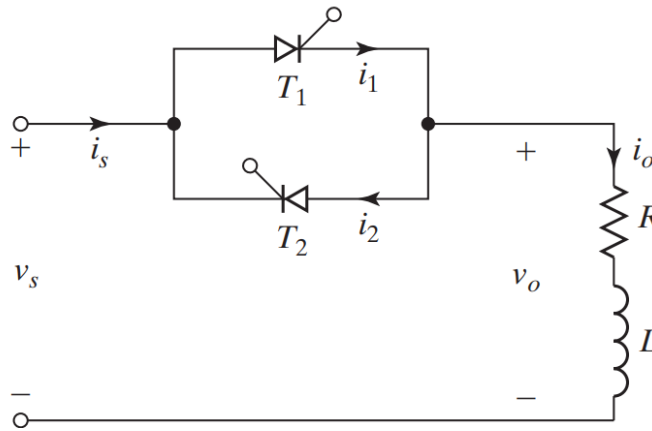


Figure 3

Assume a single-phase full-wave controller which supplies an RL load. The input RMS voltage is $V_s = 120V$ at $60Hz$. The load is such that $L = 6.5mH$, $R = 2.5\Omega$. The delay angles of thyristors are equal: $\alpha_1 = \alpha_2 = \pi/2$. Determine the following parameters:

- The conduction angle of thyristor T_1 i.e. δ

2. The RMS output voltage V_o
3. The thyristor RMS current i_R
4. The RMS output current i_o
5. The average current of a thyristor i_A
6. The input power factor

By drawing an appropriate diagram/graph of the given parameters.

Question 4:

You have been given a DC supply with an input voltage of $60V$. You have to achieve $25V$ as output. Design a Buck Converter in Simulink with the calculation of the required inductor and capacitor to be shown in your solution PDF. Take switching frequency as $25kHz$. Also, submit the Simulink model in the google form.

Question 5:

Simulate a DC-DC boost converter feeding a resistive load. Given:

1. $V_{in} = 72V$ DC
2. $V_{out} = 250V$ DC
3. Max power output = $1kW$

Design the inductor and capacitor for this converter. Show the plots of duty ratio and output voltage using MATLAB & Simulink. Take switching frequency as $10kHz$. Also, submit the Simulink model in the google form.