Lab 9: Power Transfer in AC Circuits

ECEN 214 - 517

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Due Date: November 25, 2020

Procedure

Task 1- Maximum Power Transfer with a Purely Resistive Load

For the first task the student builds a circuit shown in Figure 9.5. The student uses a sinusoidal input voltage where the peak-to-peak value is equal to 8 volts and the frequency is 10kHz. The load resistor was set to different resistances which maxed to 20k Ohms. The student measures the voltage of the load resistor and calculate the power dissipated in the load from 4k Ohm to 20k Ohm as resistances.

Task 2- Improving Power Transfer with a Shunt Capacitor

For the second task discern build the circuit shown in figure 9.6 which now includes a shunt. The stream keeps the same sinusoidal input and uses the load resistor found in Task 1 which maximizes the power delivered to the load. This led to the measurement of the voltage and power dissipated in the load resistor for a range of capacitors which started from 0.5 nF to 4 nF.

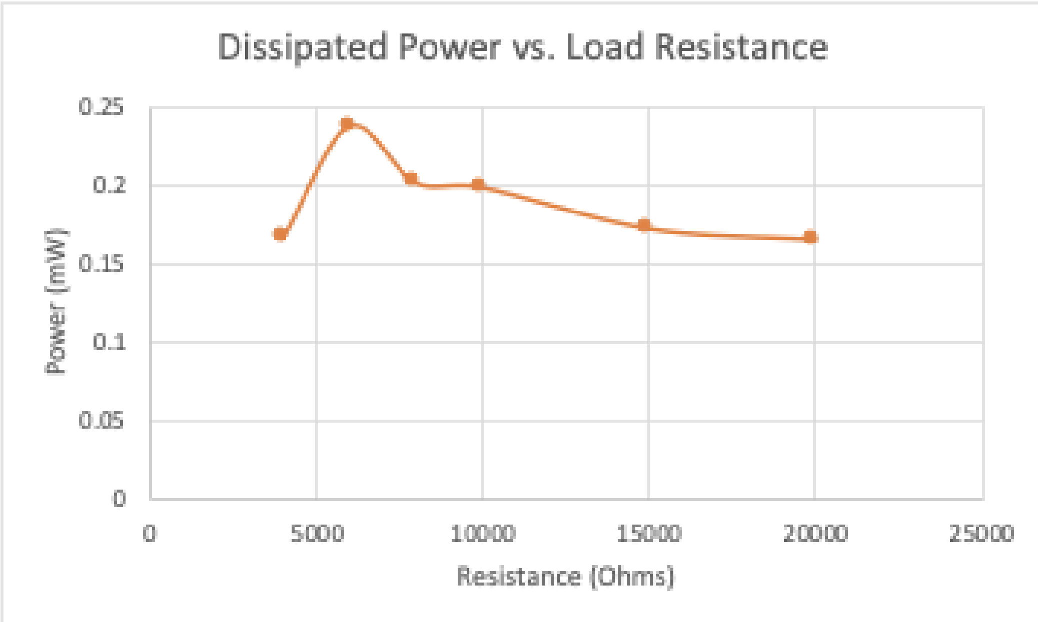
Task 3- Optimal Power Transfer

For task 3, the load resistance and capacitance was adjusted till the values that maximize the power delivered to the load resistance was found. The sinusoidal input was kept the same as Task 1 and 2.

<u>Data Tables</u>

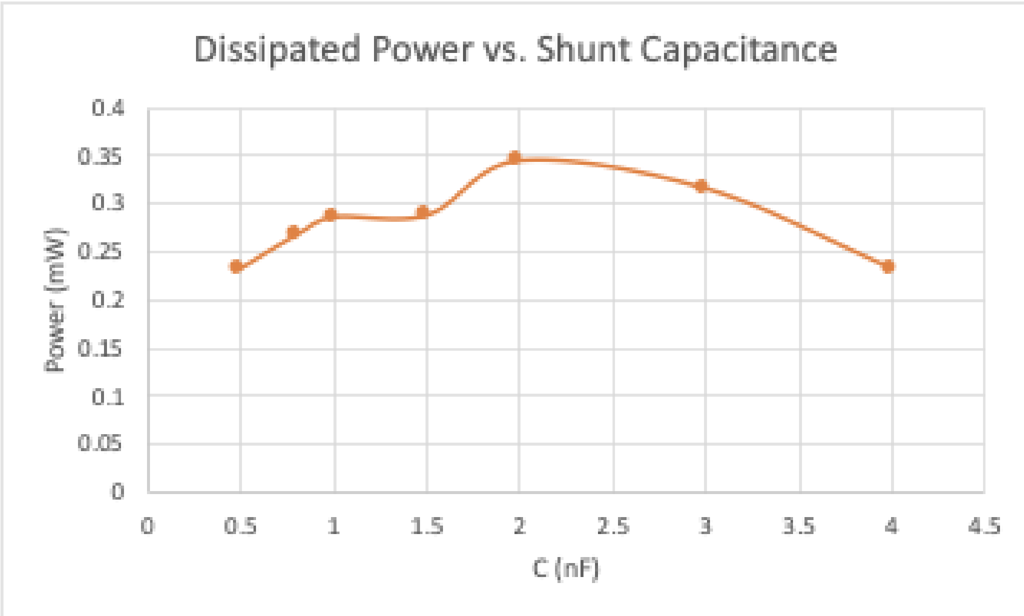
Task 1

R	V load (RMS)	Power (mW)
4000	1.16	0.166
6000	1.71	0.237
8000	1.82	0.201
10000	1.99	0.198
15000	2.29	0.172
20000	2.57	0.165



Task 2
R =6k Ohms

C (nF)	V load (RMS)	Power (mW)
0.5	1.68	0.233
0.8	1.81	0.268
1	1.86	0.286
1.5	1.87	0.288
2	2.03	0.345
3	1.96	0.316
4	1.68	0.233



Task 3
From prelab where R_L is 2200 Ohm, and C_L is 2 nF then theoretically V load is 0.7271 and Power is 0.12016.

<u>Discussion</u>

The difference in the tasks from experimental values and the theoretical values were much lower. Some factors that could have contributed to these results could be small calculation error in the prelab or that there's a varying tolerance on the resistor capacitor or the inductor. For example, if all of the true values of components were on thier extreme edge of tolerance, it could lead to a large skew in the resulting values.

The component values that are optimized leave the measured dissipated value to increase toward the calculated ideal value. This leads to the circuit functioning more efficiently which can be determined by less total power dissipation being outputted from undesirable locations. This means that more powers outputted from an ideal locations within the circuit. Furthermore this could lead to more changes in an outwardly measured power value.