EEE 202 CIRCUIT THEORY
LAB 1

Quality Factor of an Inductor

Design two methods to measure the quality factor of an inductor at 4 different frequencies.

Figure 1: An inductor model.

As shown in Figure 1 inductors can be modeled by a series ideal inductor and resistor. Q-factor of the given model is defined as

$$Q = \frac{\omega L}{R}. \tag{1}$$

Software lab

Design 2 methods to calculate the Q-factor of an inductor at a frequency between 1 and 5 MHz and simulate it by using LTspice.

- In hardware lab, axial inductors in the range of $6\mu H$ to $22\mu H$ will be provided.
- Find a similar axial inductor's datasheet and check frequency vs. Q-factor graphs. Substitute the values in the datasheet in Equation 1 to get an intuition about possible range of R.
- Choose realistic component values in the simulation.
- Make a table of results.

Hardware lab

You will use two inductors, one will be provided to you in the lab and you will wind another inductor to a core which will be provided in the lab. Measure the quality factor of both inductors using your methods at **four different frequencies** in the range of 1-5MHz, away from self-resonance frequency.

- Make a table of results.

Checks

1. SW: Explain your circuit and method. Show table of results.
2. HW: Explain your axial inductor circuit. Show table of results.
3. HW: Explain your toroidal core inductor circuit. Show table of results. Is the given model in Figure 1 an appropriate model? If you plot ω vs. Q, do your results coincide with the graphs in the datasheet?

Available materials in the lab

Toroidal cores to design inductors or transformers: T25-10, T37-7, T38-8, T50-7 from Micrometals. Capacitors with standard values. Resistors with standard values. 10cm x 10cm PCB board pieces to solder your components.