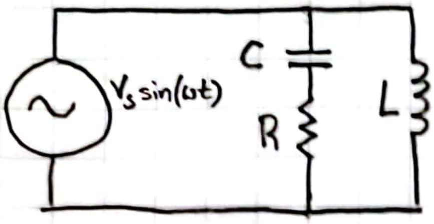
Aidan Sharpe



$$Z_{eq} = \left(R - \frac{j}{\omega C}\right) \| j\omega L$$

$$\frac{1}{Z_{eq}} = \frac{1}{R - \frac{j}{\omega C}} + \frac{1}{j\omega L} = \frac{\omega^2 R C^2}{\omega^2 R^2 C^2 + 1} + j\left(\frac{\omega C}{\omega^2 R^2 C^2 + 1} - \frac{1}{\omega L}\right.$$

$$Z_{eq} = \frac{\omega^4 R L^2 C^2}{\omega^2(R^2C^2 + \omega^2 L^2 C^2 - 2LC) + 1} + j\frac{\omega^3 L(R^2C^2 - LC) + \omega L}{\omega^2(R^2C^2 + \omega^2 L^2 C^2 - 2LC) + 1}$$

$$R_{eq} = \frac{\omega^4 R L^2 C^2}{\omega^2(R^2C^2 + \omega^2 L^2 C^2 - 2LC) + 1} \qquad X_{eq} = \frac{\omega^3 L(R^2C^2 - LC) + \omega L}{\omega^2(R^2C^2 + \omega^2 L^2 C^2 - 2LC) + 1}$$

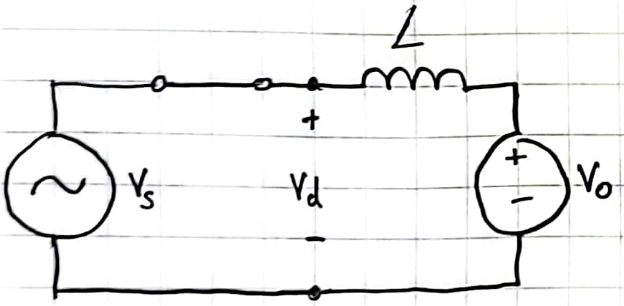
$$P = \frac{V_s^2}{|Z_{eq}|^2} R_{eq} \qquad Q = \frac{V_s^2}{|Z_{eq}|^2} X_{eq}$$

$$P = \frac{V_s^2 \omega^2 R C^2}{\omega^2 R^2 C^2 + 1} \qquad Q = \frac{V_s^2(\omega^2 R^2 C^2 - \omega^2 LC + 1)}{\omega L(\omega^2 R^2 C^2 + 1)}$$

$$\omega^2 R^2 C^2 - \omega^2 LC + 1 = 0$$

$$L = \frac{\omega^2 R^2 C^2 + 1}{\omega^2 C}$$

THD $= \emptyset$ because a pure sinusoid has no harmonics.



D is on when $V_s > V_o + V_L$

$$V_L = L\frac{di_L(t)}{dt}$$

$$V_s \sin(\omega t) = L\frac{di_L(t)}{dt} + V_o$$

As V_o increases, the peak current through the inductor decreases, and current flows through the inductor for less time.

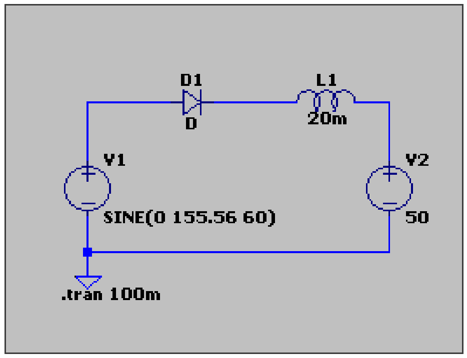


Figure 1: Charging circuit with 50v DC source as load

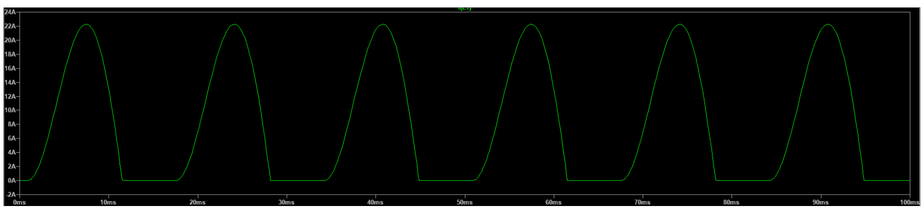


Figure 2: Current through inductor with 50v DC source as load

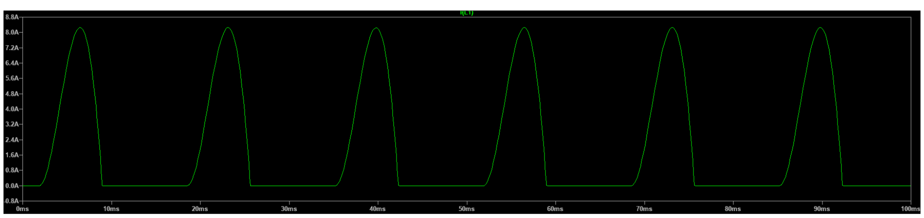


Figure 3: Current through inductor with 100v DC source as load

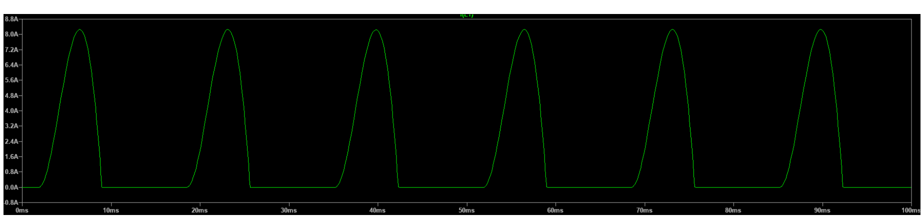


Figure 4: Current through inductor with 150v DC source as load