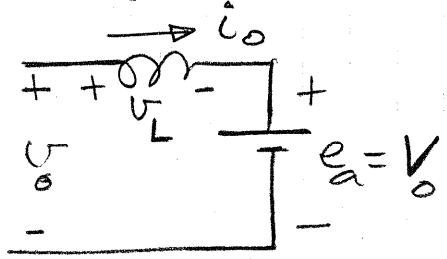
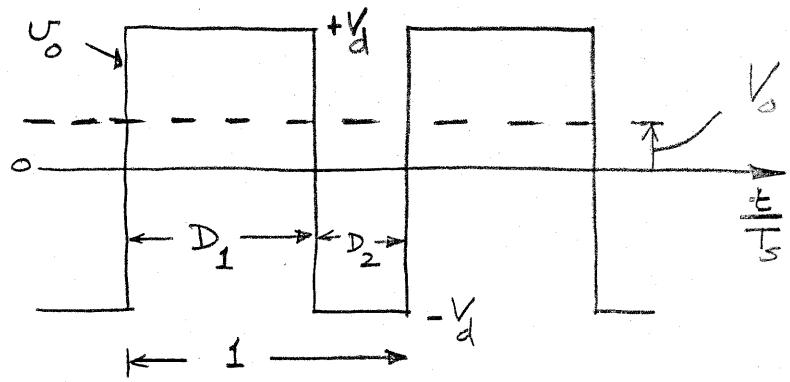
Problem 7-22

In the circuit of Fig. 7-27, $R_a \simeq 0$.

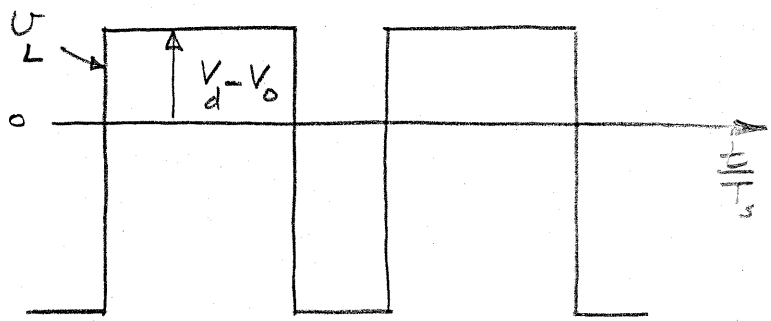
Consider the waveforms in Fig. 7-28 under steady state conditions.





during D_1: T_A^+, T_B^- ON

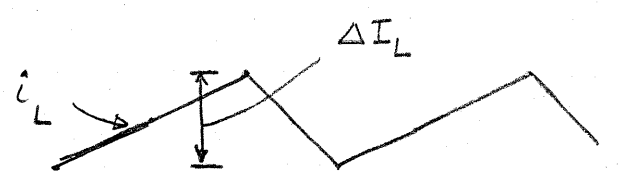
during D_2: T_A^-, T_B^+ ON



$$\Delta I_L = \frac{V_d - V_o}{L_a} D_1 T_s$$

From Eq. 7-74

$$D_1 = \frac{1}{2}\left(1 + \frac{V_o}{V_d}\right)$$



$$\therefore \Delta I_L = \frac{T_s V_d}{2 L_a}\left(1 + \frac{V_o}{V_d}\right)\left(1 - \frac{V_o}{V_d}\right)$$

$$\frac{d(\Delta I_L)}{d\left(\frac{V_o}{V_d}\right)} = \frac{T_s V_d}{2 L_a}\left(-2\frac{V_o}{V_d}\right) \underset{\text{(set to)}}{=} 0 \quad \therefore \text{ maximum occurs at } \frac{V_o}{V_d} = 0.$$

Using $\frac{V_o}{V_d} = 0$ in the equation for ΔI_L,

$$(\Delta I_L)_{\text{maximum}} = \frac{T_s V_d}{2 L_a} = \frac{V_d}{2 L_a f_s}.$$