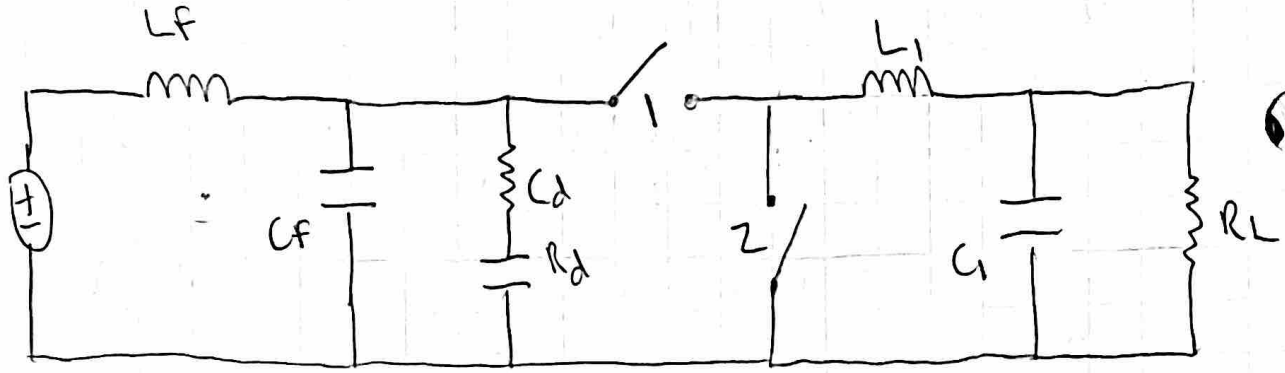
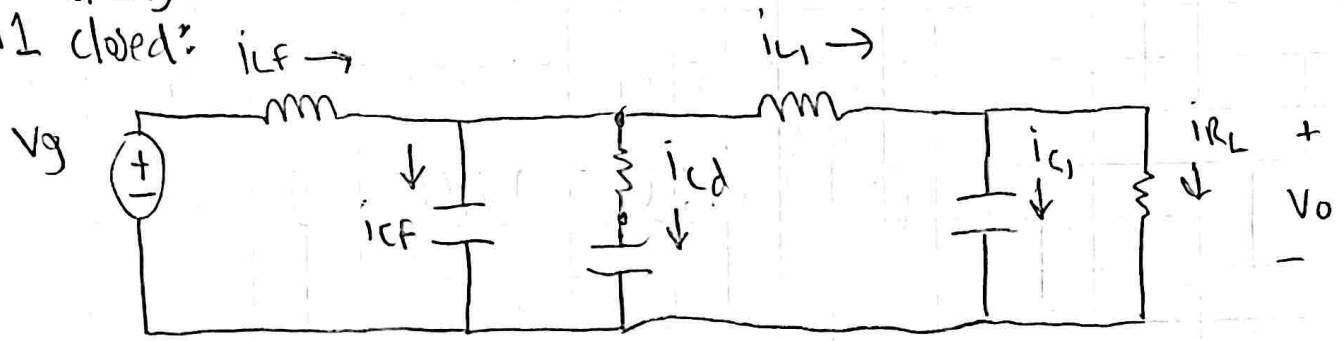


SW2 open,
SW1 closed:



$$v_{Lf} = L\frac{di_{Lf}}{dt} \qquad i_{cd} = C_d\frac{dv_{cd}}{dt}$$

$$i_{cf} = \frac{C_f dv_{cf}}{dt} \qquad v_{L1} = L_1\frac{di_{L1}}{dt}$$

$$i_{C1} = C_1\frac{dv_{C1}}{dt}$$

State variables are the quantities differentiated.

$$v_{Lf} = v_g - v_{cf}$$

$$i_{cf} + i_{cd} = i_{Lf} - i_{L1}$$

$$i_{cf} = i_{Lf} - i_{L1} - i_{cd} \qquad \left| \; i_{cd} = \frac{v_{cf} - v_{cd}}{R_d} \right.$$

$$= i_{Lf} - i_{L1} - \frac{v_{cf}}{R_d} + \frac{v_{cd}}{R_d}$$

$$v_{L1} = v_{cf} - v_{C1}$$

$$i_{C1} = i_{L1} - v_{C1}/R_L$$

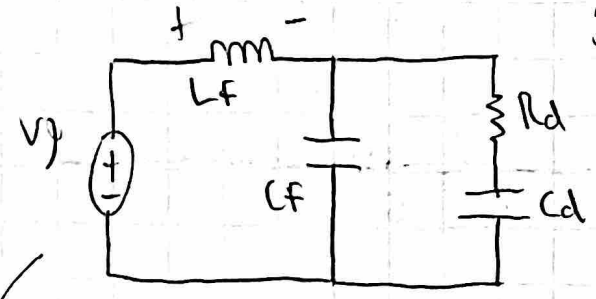
$$L_f i_{Lf}' = v_g - v_{cf} \Rightarrow i_{Lf}' =$$

$$L_1 i_{L1}' = v_{cf} - v_{C1} \Rightarrow i_{L1}' =$$

$$C_f v_{cf}' = i_{Lf} - i_{L1} - v_{cf}/R_d + v_{cd}/R_d$$

$$C_d v_{cd}' = v_{cf}/R_d - v_{cd}/R_d$$

$$C_1 v_{C1}' = i_{L1} - v_{C1}/R_L$$



SW1 open, SW2 closed:

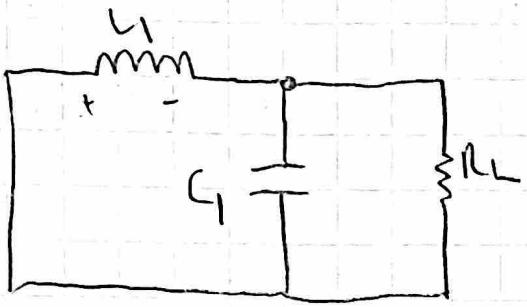
$$V_{LF} = L_F \frac{di_{LF}}{dt} \qquad i_{Cd} = C_d \frac{dV_{Cd}}{dt}$$

$$i_{CF} = C_F \frac{dV_{CF}}{dt}$$

$$V_{LF} = V_g - V_{CF}$$

$$i_{CF} = i_{LF} - i_{Cd} = i_{LF} - V_{CF}/R_d + V_{Cd}/R_d$$

$$i_{Cd} = V_{CF}/R_d - V_{Cd}/R_d$$



$$V_{L1} = L_1 \frac{di_{L1}}{dt}$$

$$i_{C1} = C_1 \frac{dV_{C1}}{dt}$$

$$V_{L1} = -V_{C1}$$

$$i_{C1} = i_{L1} - V_{C1}/R_L$$

$$\begin{bmatrix} i_{LF}' \\ V_{CF}' \\ V_{Cd}' \end{bmatrix} = \begin{bmatrix} 0 & -1/L_F & 0 \\ 1/C_F & -1/R_dC_F & 1/R_dC_F \\ 0 & 1/R_dC_d & -1/R_dC_d \end{bmatrix} \begin{bmatrix} i_{LF} \\ V_{CF} \\ V_{Cd} \end{bmatrix} + \begin{bmatrix} 1/L_F \\ 0 \\ 0 \end{bmatrix} V_g$$

$$\begin{bmatrix} i_{L1}' \\ V_{C1}' \end{bmatrix} = \begin{bmatrix} 0 & -1/L_1 \\ 1/C_1 & -1/R_LC_1 \end{bmatrix} \begin{bmatrix} i_{L1} \\ V_{C1} \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \end{bmatrix} 0$$

$$\begin{bmatrix} i_{LF}' \\ i_{L1}' \\ V_{CF}' \\ V_{Cd}' \\ V_{C1}' \end{bmatrix} = \begin{bmatrix} 0 & 0 & -1/L_F & 0 & 0 \\ 0 & 0 & 1/L_1 & 0 & -1/L_1 \\ 1/C_F & -1/C_F & -1/C_FR_d & 1/C_FR_d & 0 \\ 0 & 0 & 1/C_dR_d & -1/C_dR_d & 0 \\ 0 & 1/C_1 & 0 & 0 & -1/C_1R_L \end{bmatrix} \begin{bmatrix} i_{LF} \\ i_{L1} \\ V_{CF} \\ V_{Cd} \\ V_{C1} \end{bmatrix} + \begin{bmatrix} 1/L_F \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} V_g$$

$$A\vec{x} + Bu$$