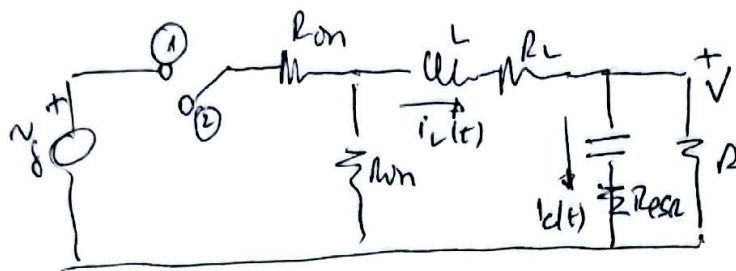


TP5 - Gestión de energía
MANUANO MOREL

①



$V = 6V$ $R_m = 25m\Omega$
 $V_g = 12$ $R_L = 50m\Omega$
 $f = 2000$ $R_{ESR} = 30m\Omega$

PARA LOS CÁLCULOS INICIALMENTE NO TOMO EN CUENTA R_{ESR}

B.V.S. (EN SRA)

① $V_g = R_m I_L + I_L R_L + V + V_L \Rightarrow V_L = V_g - R_m I_L - I_L R_L - V$

② $-I_L R_m = I_L R_L + V + V_L \Rightarrow -I_L R_m - I_L R_L - V = V_L$

B.Q.S.

$\langle i_C \rangle = 0 \rightarrow I_L = i_C + I_R \rightarrow \frac{V}{R} = I_L$

$\langle v_L \rangle = 0 = V_g \cdot D - R_m I_L \cdot D - I_L R_L (D - V_L) - I_L R_m - I_L R_L - V$
 $+ I_L R_m D + I_L R_L D + V_D$

$0 = V_g D - V_L D - I_L R_m - I_L R_L - V$
 $-V_g D = \frac{V}{R} \cdot R_m - \frac{V}{R} \cdot R_L - V$

$V_g D = V \cdot \left[1 + \frac{R_m}{R} + \frac{R_L}{R} \right]$

$M = \frac{V}{V_g} = \frac{D}{1 + \frac{R_m + R_L}{R}}$; $\frac{V}{I} = R = \frac{6V}{1A} = 6\Omega$

$\frac{6}{12} = \frac{D}{1 + \frac{25m\Omega + 50m\Omega}{6}}$

$\rightarrow D = 0,525$

Si A_{BKF60} $R_{ESR} = 30m\Omega$

$\frac{V}{V_g} = \frac{D}{1 + \frac{R_m + R_L + R_{ESR}}{R}}$

$D = 0,5275$

Para el modelo equivalente y transformación

(2)

$$C \frac{d\langle v \rangle}{dt} = (I_L + \hat{I}_L) \cdot (D + \hat{d}) - \frac{(v + \hat{v})}{R} (D + \hat{d}) + (I_L + \hat{I}_L) \cdot (1 - D - \hat{d}) - \frac{(v + \hat{v})}{R} (1 - D + \hat{d})$$

(AC)

$$\langle i_C \rangle = C \frac{d\langle v \rangle}{dt} = I_L \hat{d} + \hat{I}_L \cdot D - \frac{v}{R} \hat{d} - \frac{\hat{v}}{R} \cdot D + \hat{I}_L - \hat{I}_L \cdot D - I_L \hat{d} - \frac{v}{R} + \frac{\hat{v}}{R} \cdot D + \frac{v}{R} \hat{d}$$

$$\boxed{\langle i_C \rangle = \hat{I}_L - \frac{\hat{v}}{R}}$$

$$\langle v_L \rangle = L \cdot \frac{d\langle i_L \rangle}{dt} = \left[v_g + \hat{v}_g - \frac{R_M}{R} (v + \hat{v}) - \frac{R_L}{R} (v + \hat{v}) - (v + \hat{v}) \right] \cdot (D + \hat{d}) - \left[(v + \hat{v}) \cdot \frac{R_M}{R} + (v + \hat{v}) \frac{R_L}{R} + (v + \hat{v}) \right] \cdot [1 - D - \hat{d}]$$

(AC)

$$\begin{aligned} L \frac{d\langle i_L \rangle}{dt} &= \hat{v}_g \cdot D + v_g \cdot \hat{d} - \frac{R_M}{R} \cdot v \hat{d} - \frac{R_M}{R} \cdot \hat{v} \cdot D - \frac{R_L}{R} \cdot v \hat{d} + \frac{R_L}{R} \cdot \hat{v} \cdot D \\ &\quad + \frac{v R_M}{R} \cdot \hat{d} - \hat{v} \frac{R_M}{R} + \hat{v} \cdot \frac{R_M}{R} \cdot D + \frac{v R_L}{R} \cdot \hat{d} - \frac{\hat{v} R_L}{R} + \hat{v} \cdot \frac{R_L}{R} \cdot D \\ &\quad + v \cdot \hat{d} - \hat{v} + \hat{v} \cdot D \\ &= \hat{v}_g \cdot D + v_g \cdot \hat{d} - \hat{v} \left(1 + \frac{R_M}{R} + \frac{R_L}{R} \right) \end{aligned}$$

Si Añadigo los efectos de RESN

$$\langle v_L \rangle = L \cdot \frac{d\langle i_L \rangle}{dt} = \hat{v}_g \cdot D + v_g \cdot \hat{d} - \hat{v} \left(1 + \frac{R_M}{R} + \frac{R_L}{R} + \frac{R_{esn}}{R} \right)$$

PART A CÁLCULO DE L Y C

(3)

$$\Delta i_L^+ = \Delta i_L^- = \Delta i_L$$

$$\Delta i_L^+ = \frac{(V_g - I_L \cdot R_L - I_L R_m - V) \cdot D \cdot T_s}{L}$$

$$I_L = 1A \text{ (max)}$$

$$\Delta i_L = 10\% I_L = 0,1A$$

$$L = \frac{(V_g - I_L R_L - I_L R_m - V) \cdot D}{\Delta i_L \cdot f_s}$$

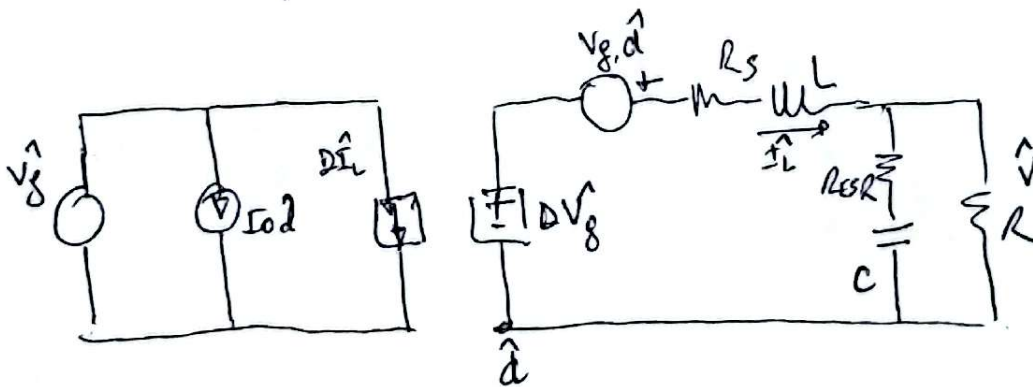
$$[L = 150,3375 \mu H]$$

$$\Delta V = \frac{\Delta Q}{C} = \frac{1}{C} \cdot \frac{1}{2} \cdot \frac{\Delta i_L}{2} \cdot \frac{T_s}{2} = \frac{\Delta i_L}{8 f_s \cdot C}$$

$$\Delta V = 5\% \cdot V = 0,3V$$

$$[C = \frac{\Delta i_L}{\Delta V \cdot 8 \cdot f_s} = 208,3 \mu F]$$

MODELO EQUIVALENTE Buck.



$$R_s = R_{on} + R_L$$

$$G_{vd}(s) = \frac{\hat{v}_o}{\hat{d}}$$

$$G_{vd}(s) = V_g \cdot \frac{1 + \frac{s}{\omega_{esn}}}{1 + \frac{1}{Q} \cdot \frac{s}{\omega_0} + \left(\frac{s}{\omega_0}\right)^2}$$

$$f_0 = \frac{1}{2\pi \cdot \sqrt{L \cdot C}} = 28,439 \text{ kHz}$$

4

$$Q_{\text{pend}} = \frac{\sqrt{\frac{L}{C}}}{R_{\text{ese}} + R_s} = 81,4 \text{ (38,21 dB)}$$

$$Q_{\text{carga}} = \frac{R}{\sqrt{\frac{L}{C}}} = 0,22 \text{ (-13,02 dB)}$$

$$Q = Q_{\text{pend}} \parallel Q_{\text{carga}} = 0,219 \text{ (-13,175 dB)}$$

$$f_{\text{res}} = \frac{1}{2\pi \cdot C \cdot R_{\text{esl}}} = 25,46 \text{ MHz}$$

$$G_{\text{vdo}} = 12 \rightarrow 21,58 \text{ dB}$$