第2回の内容

1.3 容量性エネルギーの蓄積･放出回路

1.4 誘導性エネルギーの蓄積･放出回路

0.-1エネルギーの蓄積限界値, 制限要因

第2章

2.1 高電圧発生回路

2.2 パルス波形の表し方

(1) 10%-90% 立ち上がり時間 τ_r

(2) 波頭長 τ_f

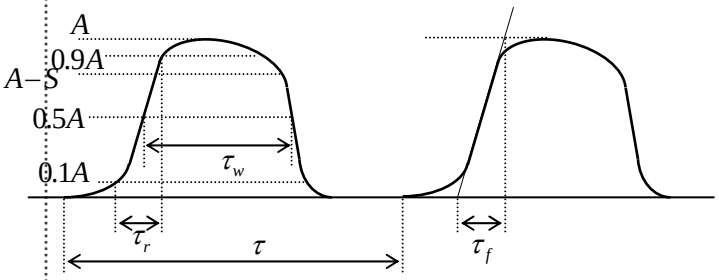
(3) パルス幅 τ_w（半値全幅）

(4) サグ $(S/A)\times 100\%$

(5) 繰り返し周期 τ（$\tau = 1/f$）

(6)デューティ比 $D = \tau_w / \tau$

(7) オーバーシュート, アンダーシュート



2.3 パルスフォーミング：PFN 回路

2.3.1 CLR 回路

(1) 減衰振動 $\dfrac{1}{LC} - \left(\dfrac{R}{2L}\right)^2 > 0, \left(\sqrt{\dfrac{L}{C}} > \dfrac{R}{2}\right)$

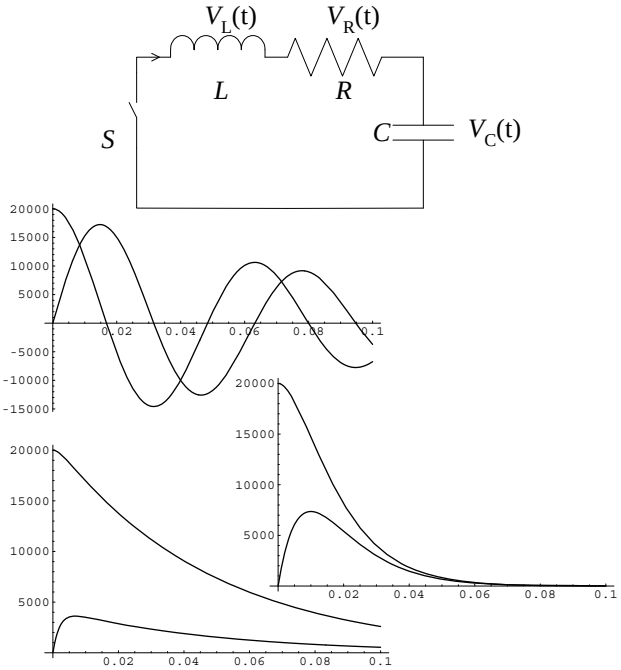
$$i(t) = \frac{V_0}{\omega_0 L} e^{\frac{-R}{2L}t} \sin \omega_0 t \quad \omega_0 = \sqrt{\frac{1}{LC} - \left(\frac{R}{2L}\right)^2}$$

(2) 臨界制動 $\dfrac{1}{LC} - \left(\dfrac{R}{2L}\right)^2 = 0$

$$i(t) = \frac{V_0 t}{L} e^{\frac{-R}{2L}t}$$

(3) 過制動 $\dfrac{1}{LC} - \left(\dfrac{R}{2L}\right)^2 < 0$

$$i(t) = \frac{V_0}{\varpi_0 L} e^{\frac{-R}{2L}t} \sinh \omega_0 t, \quad \omega_0 = \sqrt{\left(\frac{R}{2L}\right)^2 - \frac{1}{LC}}$$

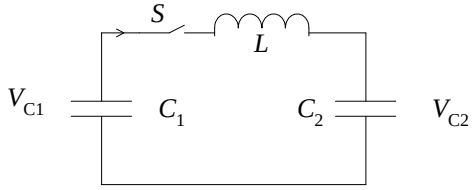


2.3.2 CLC 回路

$$i(t) = \frac{\omega_0 V_0}{\dfrac{1}{C_1} + \dfrac{1}{C_2}} \sin \omega_0 t$$

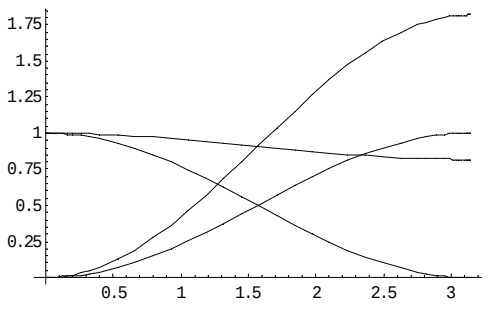
$$v_{C_1}(t) = V_0 \left[1 - \frac{C_2}{C_1 + C_2} (1 - \cos \omega_0 t) \right]$$

$$v_{C_2}(t) = V_0 \left[\frac{C_1}{C_1 + C_2} (1 - \cos \omega_0 t) \right]$$



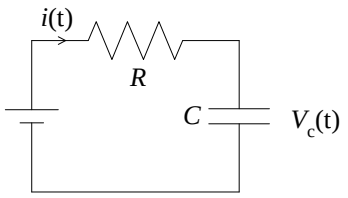
$$\omega_0 = \sqrt{\frac{1}{L}\left(\frac{1}{C_1}+\frac{1}{C_2}\right)},\ v_{C_2\max} = \frac{2V_0}{1+\frac{C_2}{C_1}}$$

$$\eta = \frac{\frac{1}{2}C_2 v_{C_2\max}^2}{\frac{1}{2}C_1 V_0^2} = 4\frac{C_2/C_1}{\left(1+C_2/C_1\right)^2}$$



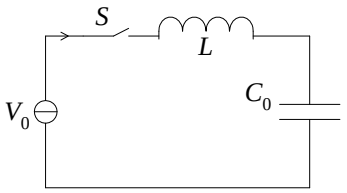
$$i(t) = \frac{V_0 - v_C(0)}{R}e^{\frac{-t}{CR}}$$

$$v_C(t) = V_0 - [V_0 - v_C(0)]e^{\frac{-t}{CR}}$$



$$v_C(t) = V_0(1-\cos\omega_0 t)$$

$$i(t) = V_0\left(\sqrt{\frac{C}{L}}\right)\sin\omega_0 t\,,\quad \omega_0 = \frac{1}{\sqrt{LC}}$$

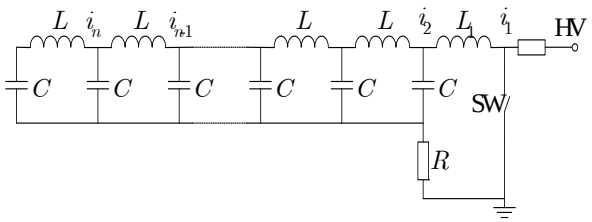


2.4 LC ラダー回路

$$Z = \sqrt{\frac{L}{C}},\ \tau_p = 2n\sqrt{LC}$$

$$V = \frac{R}{Z+R}V_0,\ I = \frac{V_0}{Z+R}$$

$$\tau_r \approx \frac{\pi}{2\sqrt{\frac{1}{L_1 C}-\frac{R^2}{4L_1^2}}}$$



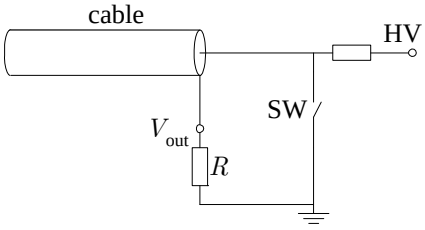
2.5 パルスフォーミングライン : PFL

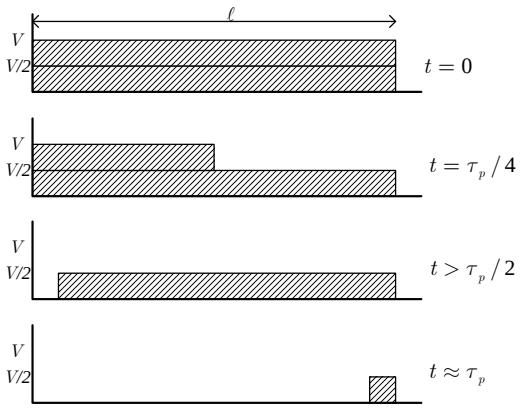
2.5.1 ケーブル放電

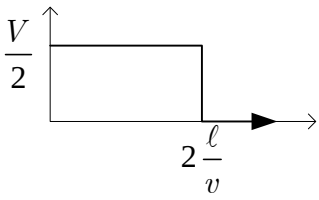
$$\tau_p = \frac{2\ell}{v} = 2\ell\sqrt{LC}$$

$$V = \frac{R}{Z+R}V_0,\ I = \frac{V_0}{Z+R}$$

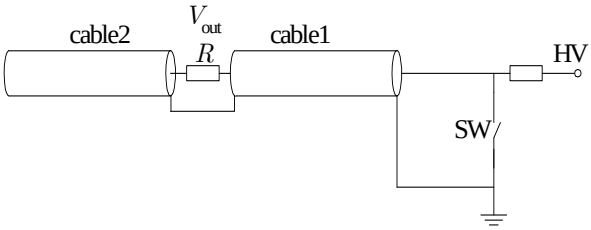
$$\tau_r = \frac{L_s}{Z_0+R}$$

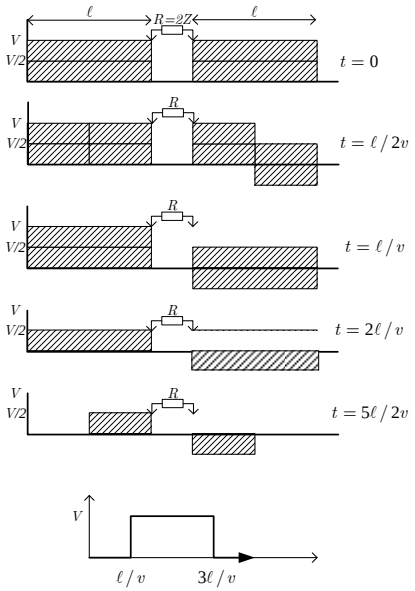




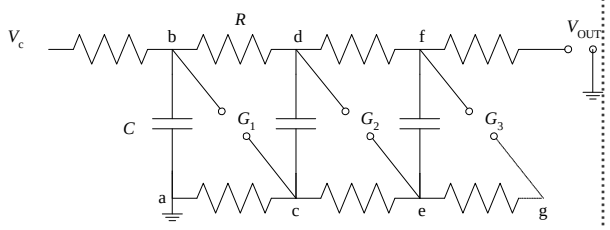


2.5.2 ブルームライン

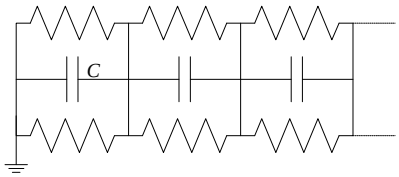




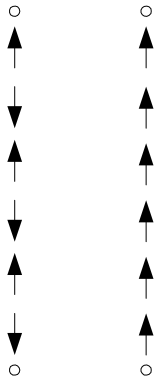
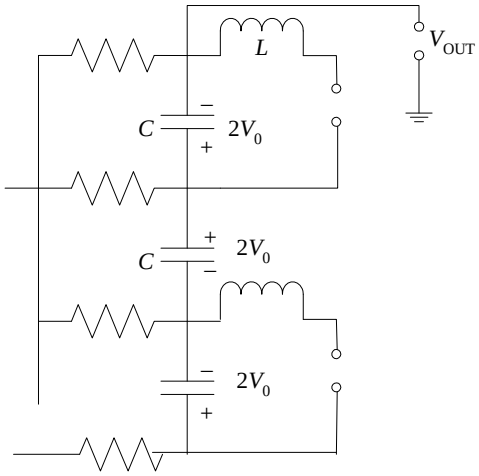
2.5 マルクス回路（Erwin Marx in 1923）



出力電圧 N$V_{c.}$, 等価回路 C /N [F]



2.6 LC 反転回路



(a) (b)