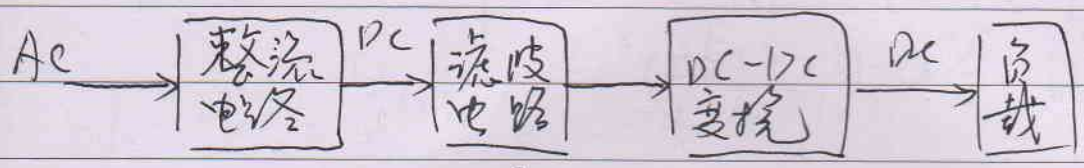
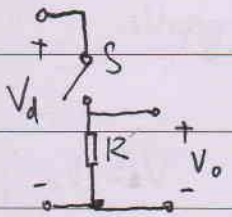
No.

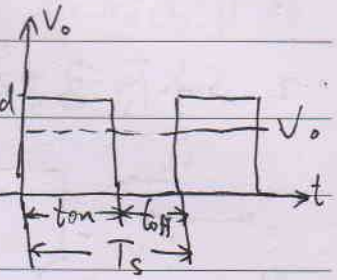
Date . .

DC-DC 变换电路

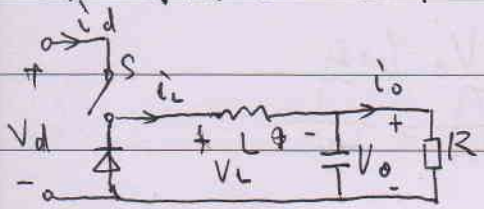




$$V_o = \frac{1}{T_s}\int_0^{T_s} V_o(t)\,dt = \frac{1}{T_s}\left(\int_0^{t_{on}} V_d\,dt + \int_{t_{on}}^{T_s} 0\cdot dt\right) = \frac{t_{on}}{T_s} V_d = \delta V_d$$



1. 降压式变换电路



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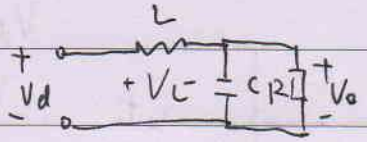

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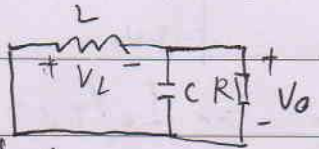
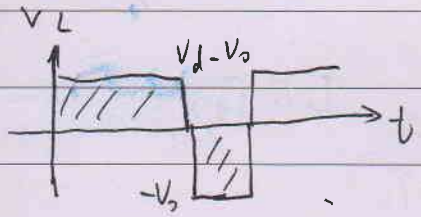




$V_L = L\,di_L/dt$ 周期 T_s 内 i_L 平均值为零，即 $\int_0^{T_s} V_L\,dt = L\bar{I}_L\cdot T_s = 0$

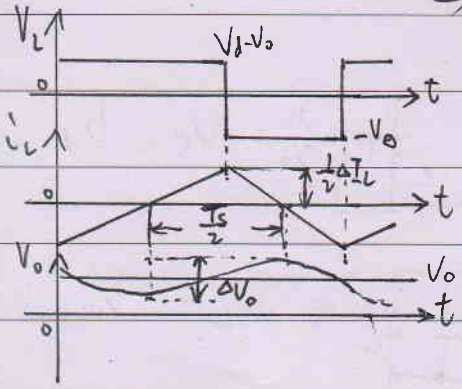
$\therefore \int_0^{T_s} V_L\,dt = 0$

$(V_d - V_o)\,t_{on} - V_o\,t_{off} = 0 \Rightarrow V_d\,t_{on} = V_o\cdot T_s$

~~$V_d\,t_{on} = V_o\cdot t_{on}$~~ $\Rightarrow V_o = t_{on}/T_s \cdot V_d = \delta V_d$

$V_o/V_d = \delta$ $\quad P_d = P_{on} \Rightarrow V_d\cdot I_d = V_o\cdot I_o$

$\Rightarrow I_o/I_d = \frac{1}{\delta}$



$\Delta V_o = \Delta Q/C = \frac{1}{C}\cdot\frac{1}{2}\cdot\frac{\Delta I_L}{2}\cdot\frac{T_s}{2}$

$u_L = L\,di/dt \Rightarrow V_o = L\cdot\Delta I_L/(1-D)\cdot T_s$

$\Delta I_L = \frac{V_o}{L}\cdot(1-D)T_s \Rightarrow$

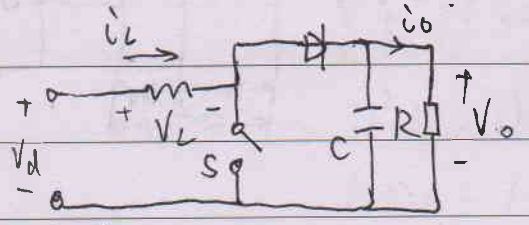
$\Delta V_o = \frac{1}{8C}T_s\cdot\frac{V_o}{L}\cdot(1-D)T_s = \frac{1}{8}\cdot\frac{T_s^2(1-D)}{LC}V_o$

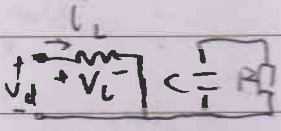
开关频率 $f_s = \frac{1}{T_s}$

转折频率 $f_c = \frac{1}{2\pi} \cdot \frac{1}{\sqrt{LC}}$ $\Rightarrow$ ① $f_c \ll f_s$ 抑制纹波 ② 纹波与输出功率无关

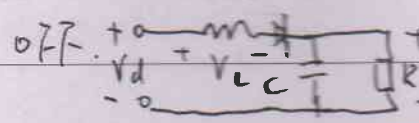
故 $\Delta V_o / V_o = \frac{\pi^2}{2}(1-D) \cdot \left(\frac{f_c}{f_s}\right)^2$

2. 升压变换电路

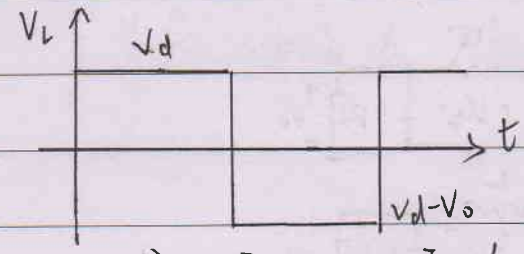


ON: 

$V_L = V_d$

OFF: 

$V_L = V_d - V_o$

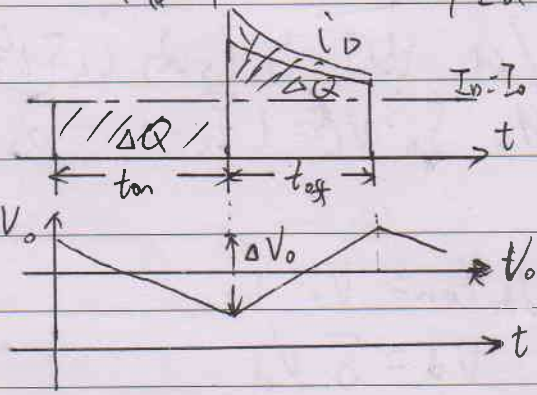


$V_d t_{on} + (V_d - V_o) \cdot t_{off} = 0$

$V_d \cdot T_s = V_o \cdot t_{off}$

$V_o / V_d = \frac{T_s}{t_{off}} = \frac{1}{1-D}$

$P_d = P_o \Rightarrow I_o / I_d = 1-D$



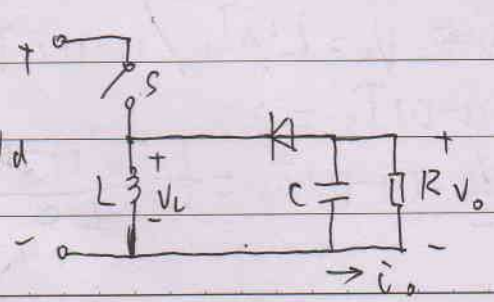
$\Delta V_o = \Delta Q / C = I_o D T_s / C$

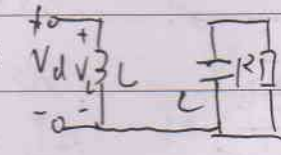
$= \frac{V_o}{R} \cdot \frac{D T_s}{C}$

$\frac{\Delta V_o}{V_o} = D T_s / RC = D T_s / \tau$

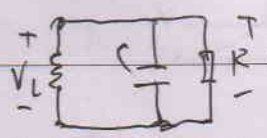
$\tau = RC$

3. 升降压式变换电路



ON: 

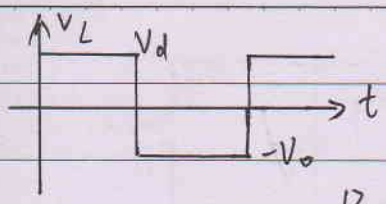
$V_L = V_d$

OFF: 

$V_L = -V_o$

No.

Date . .



$V_d \cdot t_{on} - V_o t_{off} = 0$

$V_o/V_d = \frac{t_{on}}{t_{off}} = D/(1-D)$

$P_o = P_d \quad I_o/I_d = (1-D)/D$

$\Delta V_o = \Delta Q/C = I_o D T_s/C = V_o/R \times DT_s/C$

$\Delta V_o/V_o = DT_s/Re = DT_s/\tau$ $\tau = Re$ 时间常数