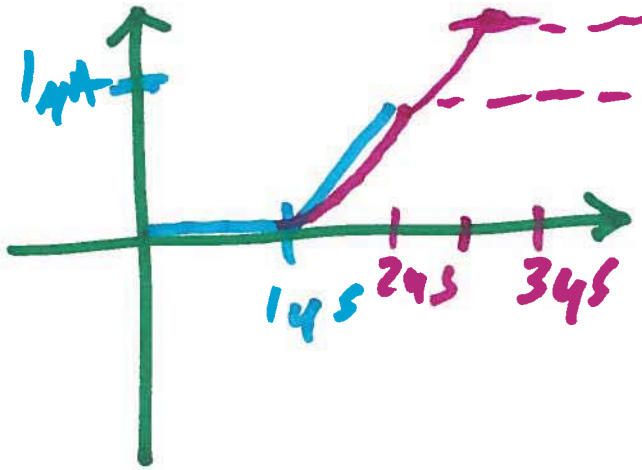
EE 220 Circuits 1

Lecture 16

OCTOBER 25, 2017

$i(t)\ \frac{1\mu A}{1\mu s} \cdot t = t$



$i = C\frac{dv}{dt}$

$V = \frac{1}{C}\int_0^t i\,dt$

$V = \frac{1}{10pF}\,\frac{1}{2}t^2$

$\frac{(1\mu s)^2}{20pF} = \frac{1}{20} = 0.05$

$$i(t) = -\frac{24A}{14s} \cdot t + 14A$$

$$V(t) = \frac{1}{C}\int_{0,24s}^{14s,34s} (-2t + 14A)\,dt$$

$$= \frac{1}{10pF}\left[-t^2 + 14A \cdot t\right]$$

$$V(0) = 0$$

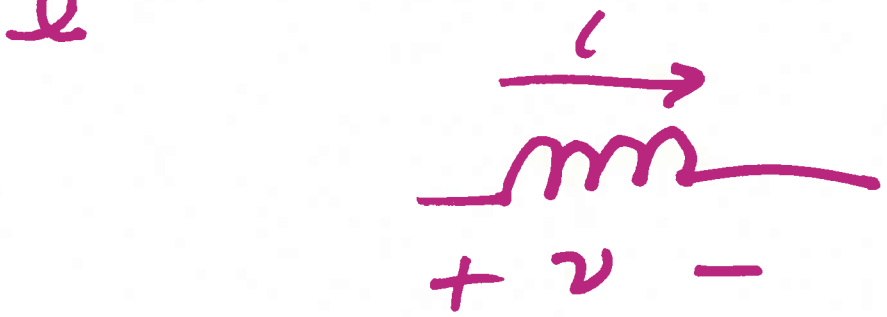
$$V\left(\tfrac{1}{2}4s\right) = \frac{1}{10pF}\left[-(0.5\times10^{-4}s)^2 + 10A \cdot 10^{-4} \cdot \frac{1}{2}s\right]$$

$$= \frac{1}{10}\left[-.25 + \frac{1}{2}\right] = \frac{.25}{10}$$

$$\frac{1}{40} = 0.025$$

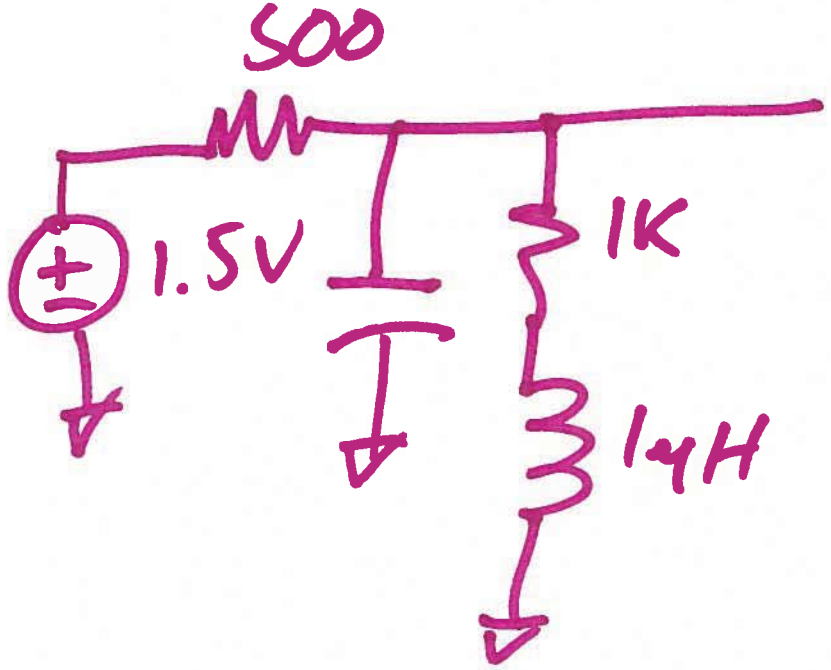
2)

Inductors (Henrys)

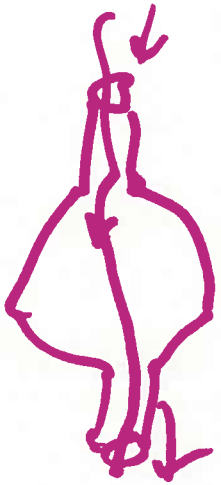


$$v(t) = L \cdot \frac{di(t)}{dt}$$

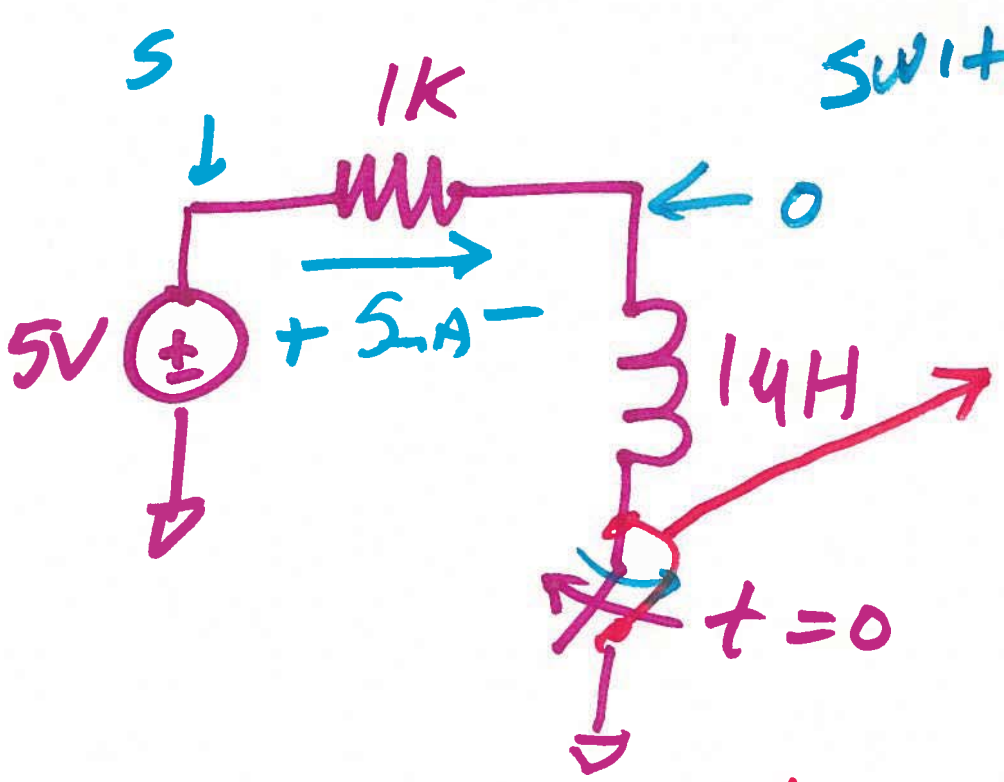
$$i(t) = \frac{1}{L} \int v(t) \cdot dt$$



$V_{OUT} = 1V$

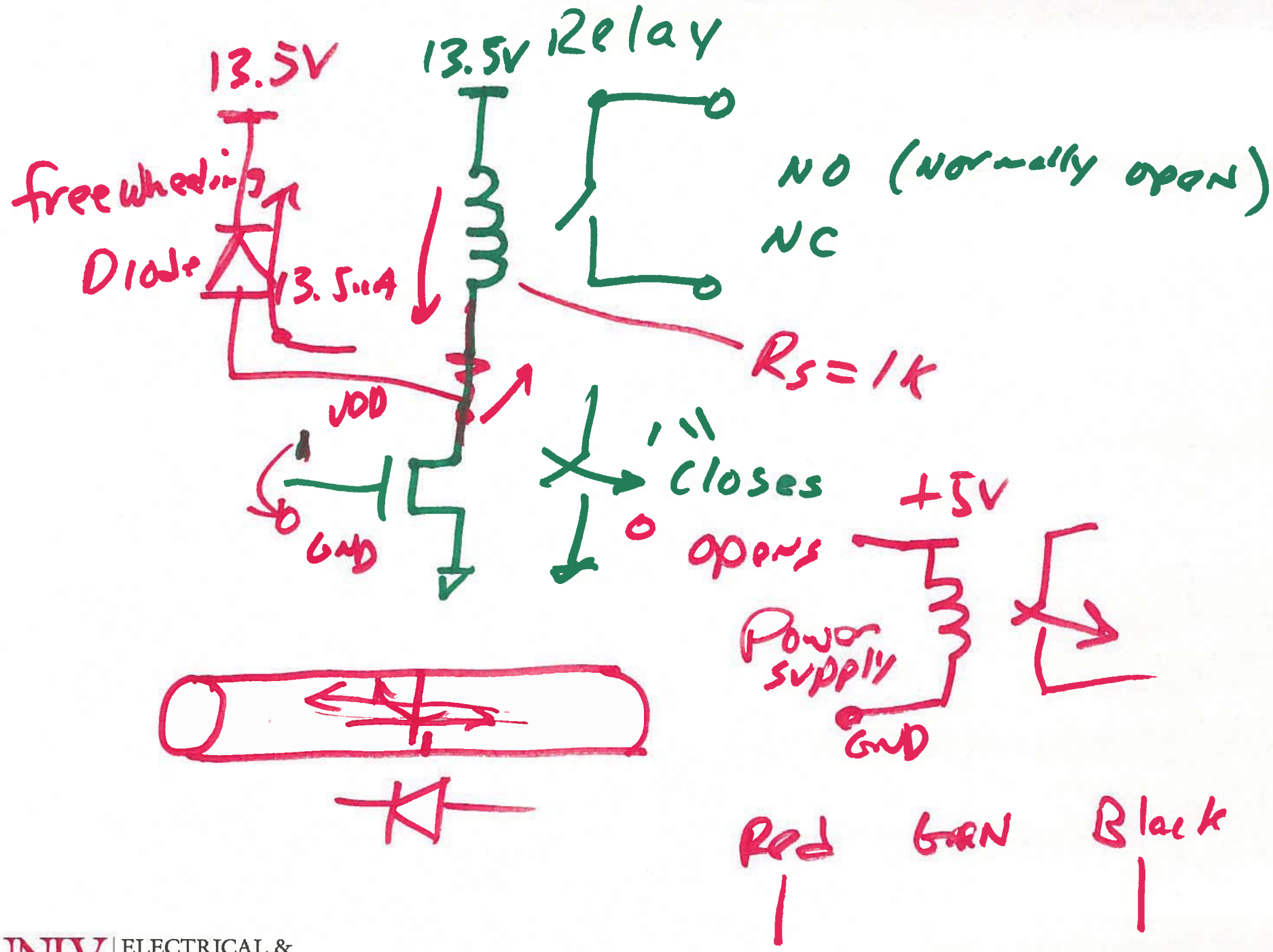


Magnetic flux



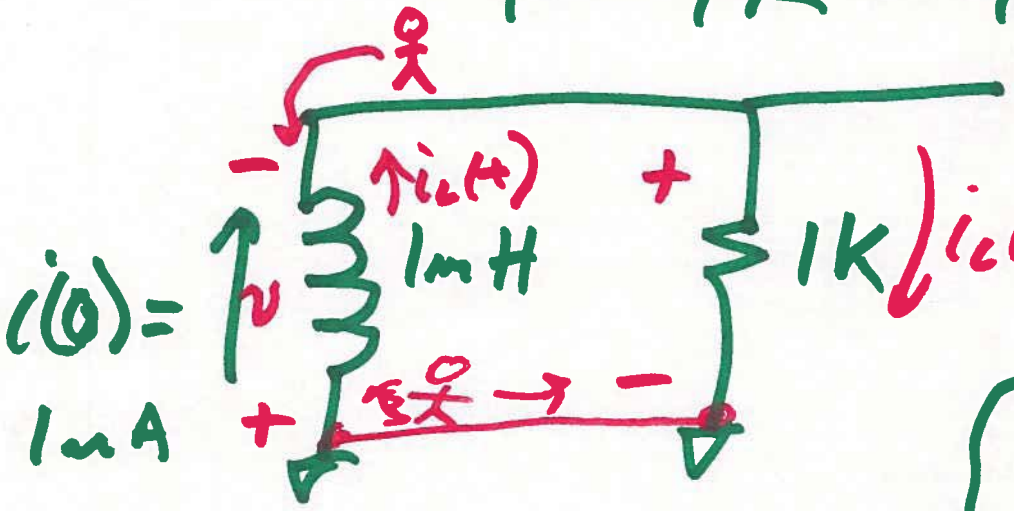
switch closed for a long time

$$\frac{L}{R} = \frac{10^{-6}}{10^{3}} = \frac{1\mu H}{1K} = 10^{-9}\,s$$


13.5V
13.5V
relay
freewheeling
Diode
13.5-0.4
NO (normally open)
NC
$R_S = 1k$
VDD
GND
closes
opens
+5V
Power supply
GND
Red
Green
Black

$\tau = L/R = \frac{1mH}{1K} = 1\mu s \quad v_i = 1V$

$v_L(t) \quad v_f = 0$



$v_L(t) = v_f + (v_i - v_f)e^{-t/\tau}$

$v_L(t) = 1V \cdot e^{-t/1\mu s}$

$1K \cdot i_L(t) + L \cdot \frac{di_L(t)}{dt} = 0$

$v = L\frac{di}{dt}$

$-1K \cdot i_L(t) = 1mH \cdot \frac{di_L(t)}{dt}$

$i_L(t) = i(0_-)e^{-t/1\mu s}$

$-t = \int_{i(0_-)}^{i_L(t)} -dt = \int_{i(0_-)}^{i_L(t)} 1\mu s \cdot \frac{di_L(t)}{i_L(t)} = 1\mu s \cdot \ln\frac{i_L(t)}{i(0_-)}$

$i_L(t) = i(0_-)e^{-t/1\mu s}$

6)