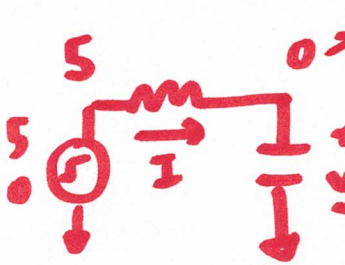
EE 220: Circuits I

Capacitors (AC short / DC open)

→ Farads

* store energy as electric field
* resist changes in their voltage
* $I_c = C \cdot \frac{dV_c}{dt}$
* made of two conductive plates with a dielectric in between



$I = C\frac{dV}{dt}$

$I_1 = \frac{V}{R} = \frac{5V}{R}$

$I_2 = \frac{V}{R} = \frac{5V-1V}{R}$

Inductors (AC open / DC short)

→ Henrys

* store energy as magnetic field
* resist changes in their current
* $V_L = L \cdot \frac{dI_L}{dt}$
* made of a wire wrapped around a magnetic material

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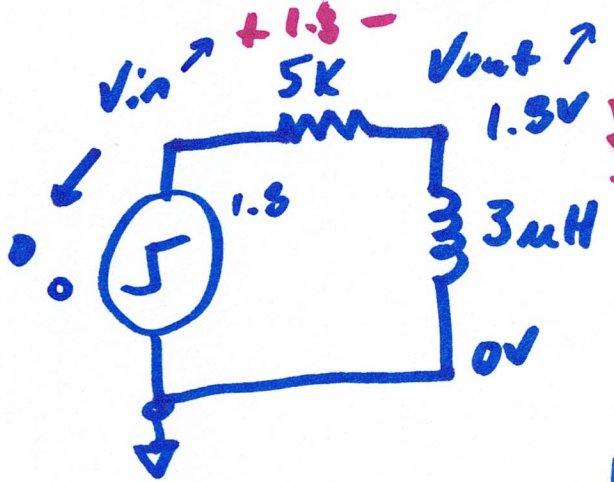
Quiz 14

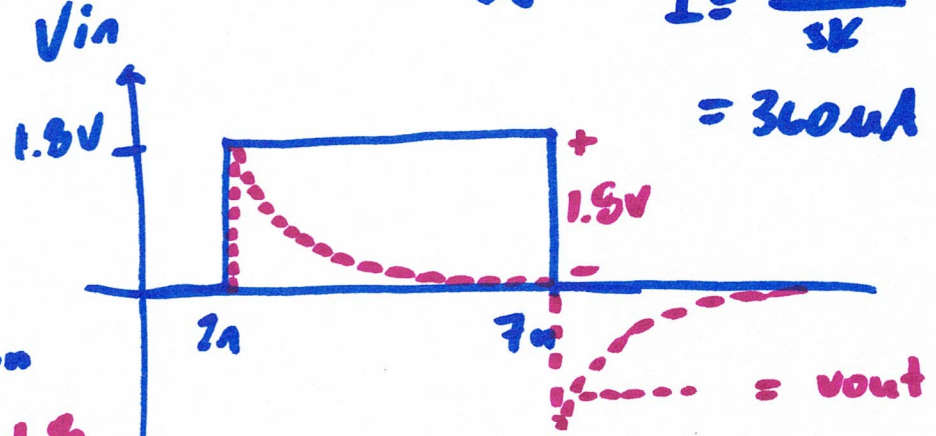


$\tau = 0.6ns = \frac{L}{R} = \frac{3\mu H}{5K\Omega}$

$V_L = L\frac{\partial I}{\partial t}$

$I = \frac{1.8-0}{5K}$

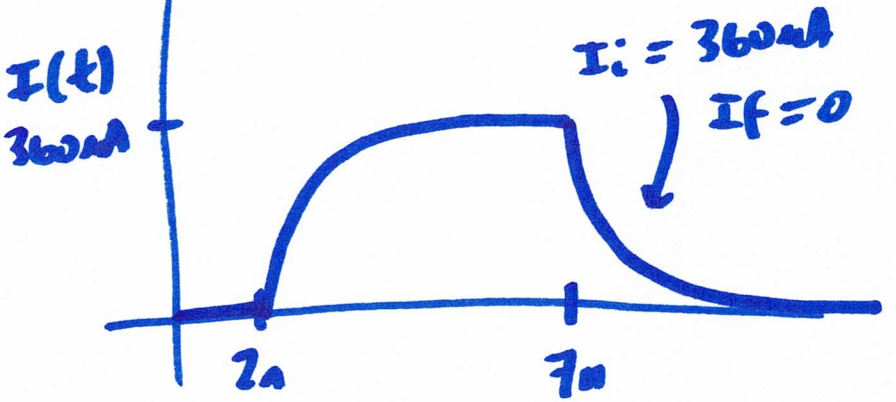
$= 360\mu A$



$I(t) = I_f + (I_i - I_f)e^{-t/\tau}$

$I_1(t) = 360mA + (0 - 360mA)e^{-(t-2ns)/0.6n}$

$$I(t) = \begin{cases} 0 & t < 2n \\ I_1(t) & 2n \le t < 7n \\ & t \ge 7n \end{cases}$$



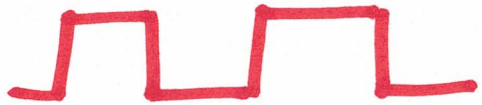
AC circuits

$f = 1\,kHz$

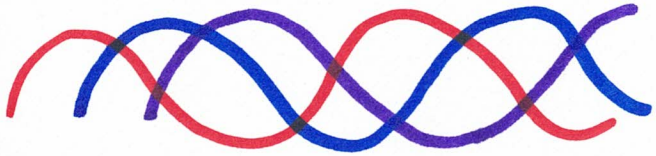
$f = \frac{1}{T} \leftrightarrow T = \frac{1}{f}$

types of signals:

sine



square



triangle

sawtooth

(rad/s) angular — (Hz) actual

$\omega = 2\pi \cdot f$

mainly focused on sine waves: $v(t) = V_A \sin(\omega t + \phi)$

ω: angular frequency (rad/s)

V_A: amplitude

ϕ: phase shift

$\sin(650t)$

$t \quad \frac{650}{2\pi} = f$

$v(t) = V_A \sin(2\pi \cdot f \cdot t + \phi)$

$2 \sin(2\pi \cdot 1k \cdot t + \phi)$

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