ENGR-4300 **Crib Sheet** **Quiz 1**

	Resistor	Capacitor	Inductor
symbol	 R	 C	 L
general equation	$V_R=I_R R$	$I_C=C(dV_C/dt)$	$V_L=L(dI_L/dt)$
combining in series	$R_T = R_1 + R_2 + \ldots + R_n$	$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \Lambda + \frac{1}{C_n}$	$L_T = L_1 + L_2 + \ldots + L_n$
two in series	$R_{12} = R_1 + R_2$	$C_{12} = \frac{C_1 C_2}{C_1 + C_2}$	$L_{12} = L_1 + L_2$
combining in parallel	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \Lambda + \frac{1}{R_n}$	$C_T = C_1 + C_2 + \ldots + C_n$	$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \Lambda + \frac{1}{L_n}$
two in parallel	$R_{12} = \frac{R_1 R_2}{R_1 + R_2}$	$C_{12} = C_1 + C_2$	$L_{12} = \frac{L_1 L_2}{L_1 + L_2}$
f->0	R	open circuit	short circuit
f->∞	R	short circuit	open circuit

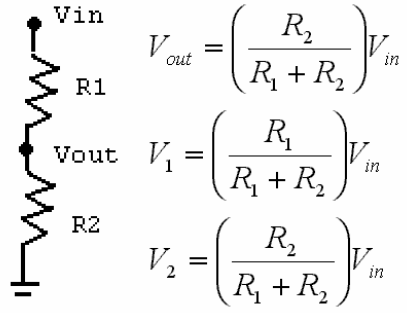
Ohm's Law: V=IR $V_T = I_T R_T$

Kirchoff's voltage law: sum of voltages in loop is 0

Kirchoff's current law: sum of currents entering a junction = sum of currents exiting a junction

Harmonic Oscillation: $\frac{d^2V}{dt^2} + \omega_r^2 V = 0 \quad \omega_r = \frac{1}{\sqrt{LC}} \quad \frac{Ewt^3}{4l_1^3} = (m_{beam} + m_1)(2\pi f_1)^2$

Voltage Dividers:

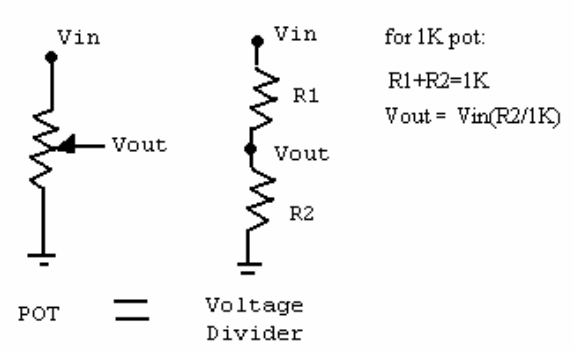


$$V_{out} = \left(\frac{R_2}{R_1 + R_2}\right) V_{in}$$

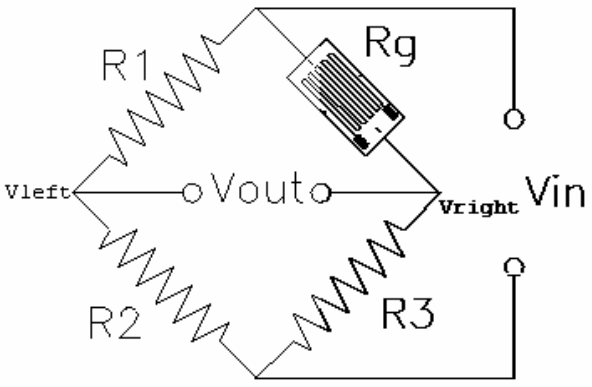
$$V_1 = \left(\frac{R_1}{R_1 + R_2}\right) V_{in}$$

$$V_2 = \left(\frac{R_2}{R_1 + R_2}\right) V_{in}$$

Pots:



Bridges



Vout = dV = Vleft-Vright

$$\mathbf{V_{out} = V_{in}\left[\frac{R2}{R1+R2} - \frac{R3}{R3+R_g}\right]}$$

Two voltage dividers in parallel

Thevenin Equivalents

step 1) Find V_{th} (set load (A-B) to open and find V_{AB})

step 2) Find R_{th} (set voltage sources to short and find combined resistance between A and B)

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Regular Sine Waves

$$v(t) = A\sin(\omega t + \phi) + V_{DC} \qquad \omega = 2\pi f \qquad f = \frac{1}{T} \qquad \phi = -\omega t_0 = -2\pi\frac{t_0}{T}$$

$$V_{rms} = \frac{A}{\sqrt{2}} \qquad V_{p\text{-}p} = 2A$$

Decaying Sinusoids

$$v(t) = A\, e^{-\alpha t}\sin(\omega t + \phi) \qquad v_1 = v_0\, e^{-\alpha(t_1 - t_0)}$$

Logarithmic Scales

+---------+---------+----a----+c--------+---------+-------b-+---------+
10^0 10^1 10^2 10^3 10^4 10^5 10^6 10^7
(1) (1K) (1Meg)

point a: $10^{(0.5)} \times 10^2 = 3.2 \times 10^2 = 320$ Hz or $10^{(2.5)} = 320$ Hz
point b: $10^{(0.8)} \times 10^5 = 6.3 \times 10^5 = 630{,}000$ Hz or $10^{(5.8)} = 630{,}000$ Hz
point 1200 Hz: log(1.2) = .08 decade = 10^3 at c or log(1200) = 3.08 at c

PSpice Component	Library	PSPice Component	Library
R	ANALOG	VDC	SOURCE
C	ANALOG	VSIN	SOURCE
L	ANALOG	0 (GND)	SOURCE
POT	BREAKOUT	Sw_tOpen, Sw_tClose	EVAL
prefix (abbr in PSpice)	value	prefix (abbr in PSpice)	value
tera (t)	10^{12}	pico (p)	10^{-12}
giga (g)	10^9	nano (n)	10^{-9}
mega (meg)	10^6	micro (u)	10^{-6}
kilo (k)	10^3	milli (m)	10^{-3}

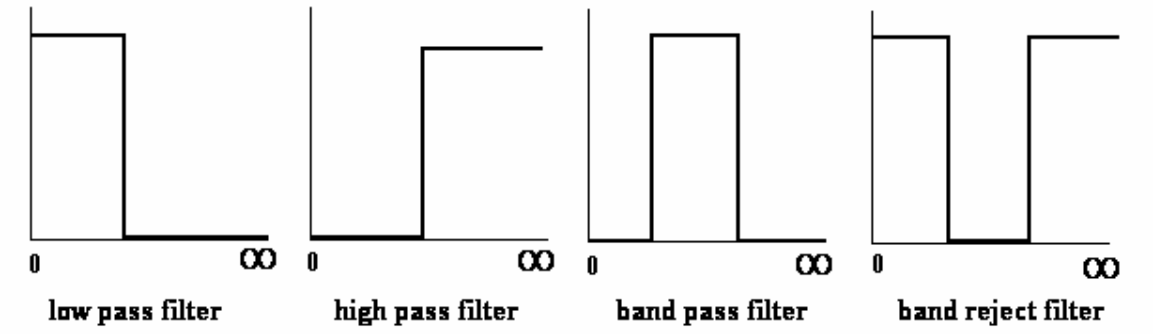
Reading Resistors

black-brown-R-O-Y-G-B-V-grey-white
0 - 1 -2 -3- 4-5- 6- 7- 8 - 9
XYZ = XY x 10^Z ohms

Reading Capacitors

XYZ = XY x 10^Z picofarads = XY x 10^{Z-6} microfarads

Filters



Lissajous Figures