DC to AC Converter

3) Assume the Fourier transform for the output of a DC to AC converter driving a 1 Ohms reisistor is as follows:

- note: units are Vp (peak voltage)

Harmonic	0 (DC)	1	2	3	4	5
an (cosine)	0	18.3	0	2.6	0	0.7
bn (sine)	0	2.7	0	0	1.4	0
Energy (W) $(a_n^2 + b_n^2)/2$	**0**	**171.09**	**0**	**3.38**	**0.98**	**0.24**

Determine the following:

Total Energy in the signal	Energy in the 1st harmonic	Efficiency % of energy in the 1st harmonic
175.69W	**171.09W**	**97.4%**

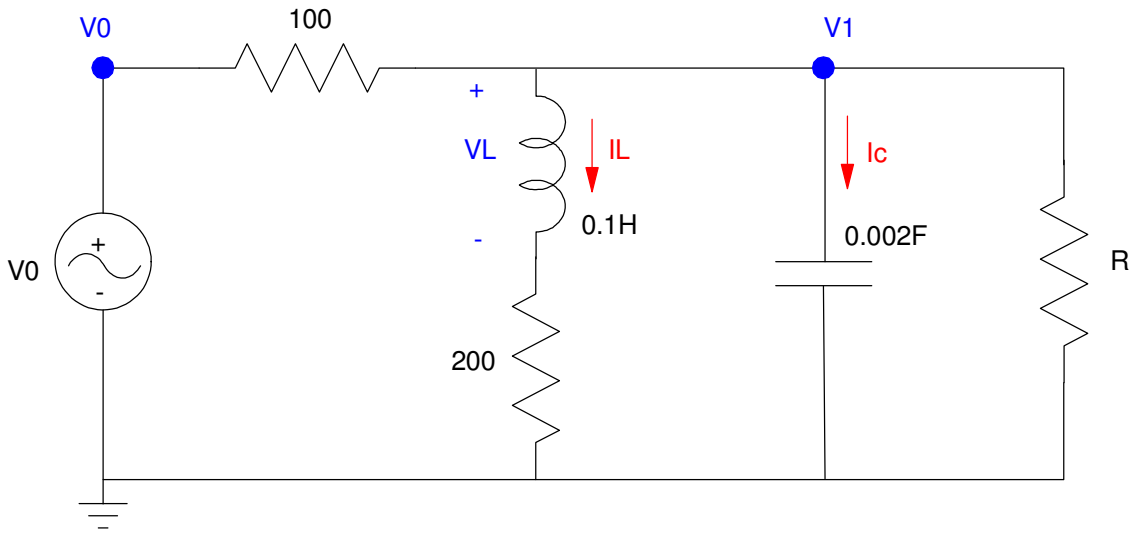
DC to AC Converter: Differential equations for a Circuit

4) Determine the differential equations which describe the following circuit. Note

- $_L = L\frac{I_L}{}$
- $I \ = C\frac{1}{t}$

Assume R = 1000 + 100*(Birth Month) + (Birth day). For May 15th, for example, R = 1514 Ohms.

$\frac{I_L}{t} = 10 \ _1 - 2000I_L$
$\frac{1}{t} = 5 \ _0 - 5.33 \ _1 - 500I_L$



$_L = 0.1\frac{I_L}{t} = \ _1 - 200I_L$

$\frac{I_L}{t} = 10 \ _1 - 2000I_L$

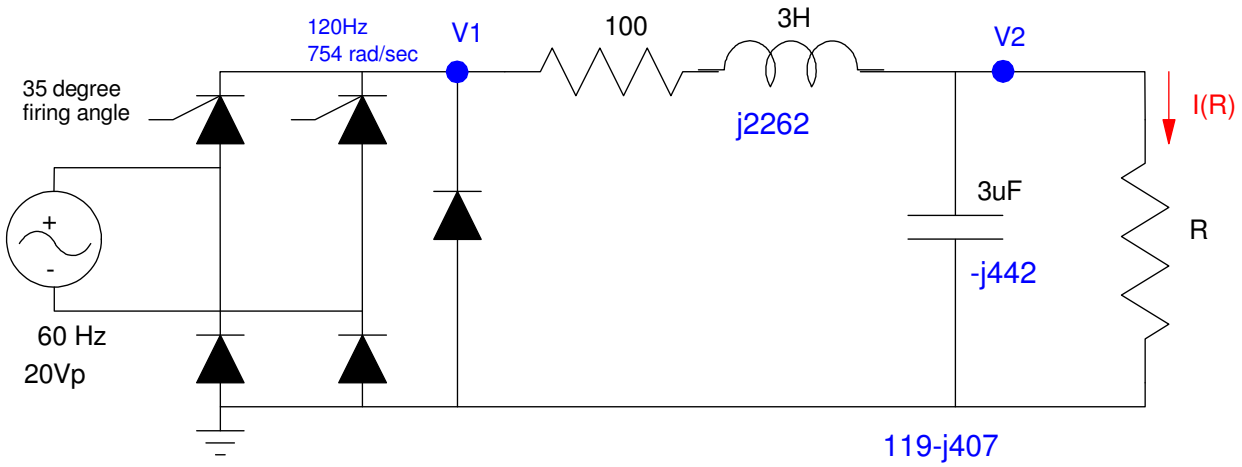
$0.002\frac{1}{t} = \frac{0^- \ 1}{100} \ - I_L - \frac{1}{1514}$

$\frac{1}{t} = 5 \ _0 - 5 \ _1 - 500I_L - 0.33 \ _1$

SCR (5 diode version)

5) SCR: Analysis. Determine the votlages at V1 and V2 (both DC). Assume a firing angle of 35 degrees.

R 1000 + 100*Mo + Day	V1		V2	
	DC	AC (V1pp)	DC	AC (V2pp)
1514	**10.48**	**19.3Vpp**	**9.83**	**4.39Vpp**



35 degrees

$$_1(DC) = \frac{18.6\ +0.7}{\pi}\ (1+\cos(35^0)) - 0.7 = 10.476$$

$$_1(AC) = 19.3\ _{pp}$$

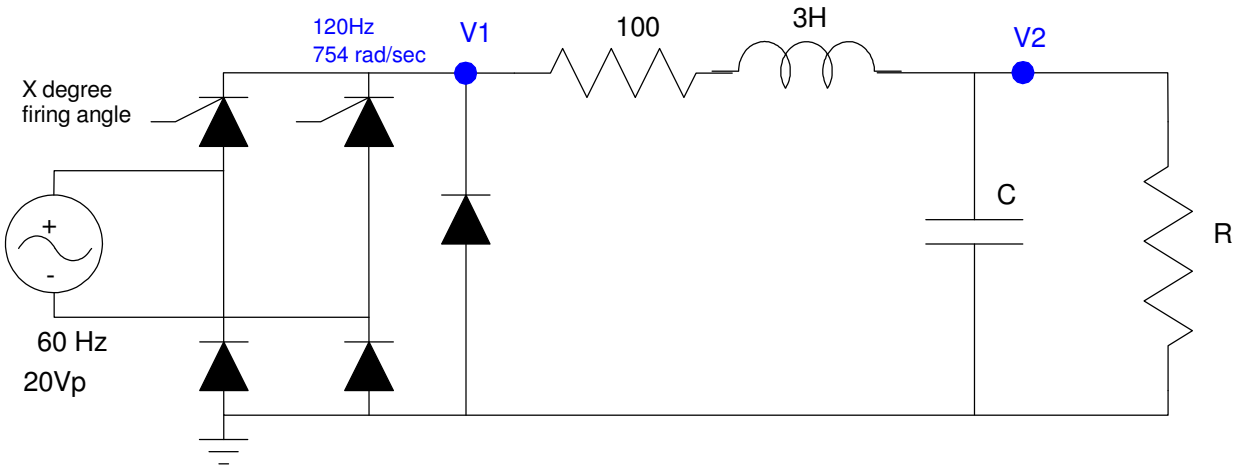
$$_2(DC) = \frac{1514}{1514+100}\ 10.476\ = 9.827$$

$$_2(AC) = \frac{119 - 407}{(119 - 407)+(100+ 2262)}\ 19.3\ _{pp} = 4.386\ _{pp}$$

6) SCR Design. Determine the firing angle and C so that

- V2(DC) = 4.5V
- V2(AC) = 500mVpp
- R = 1000 + 100*(Birth Month) + (Birth Day). May 14th would give R = 1514 Ohms.

V1(DC)	Firing Angle	C	R 1000 + 100*Mo + Day
4.797V	**96.03 deg**	**18.1uF**	**1514**



$$_2 = \frac{1514}{1514+11} \quad _1 = 4.50$$

$$_1 = 4.797$$

$$_1 = 4.797 \quad = \frac{18.6 \ +0.7}{\pi} \quad (1+\cos(\theta)) - 0.7$$

$$\theta = 96.037^0$$

$$_1(AC) = 18.489 \quad -(-0.7 \ ) = 19.189 \quad _{pp}$$

If C = 0

$$_2(AC) = \frac{1514}{1514+(100+\ 2262)} \quad 19.189 \quad _{pp} = 10.373$$

to bring the ripple down to 0.5Vpp

$$\left|\frac{1}{\omega C}\right| = \frac{0.5 \ pp}{10.373 \ pp} \quad 1514\Omega = 72.98\Omega$$

$$C = 18.1\mu F$$