ECE 320 - Homework #6

H-Bridge, DC to DC Converters, Fourier Transforms. Due Monday, October 5th

H-Bridges:

The following circuit is 1/2 of an H-bridge. (the mirror image (minus the 2.5V supply) is repeated to the right for a full H-bridge). Also note: the 50 Ohm & 2.5V source is the Thevenin equivalent of two 100 Ohm resistors (shown to the right). The circuit to the right is easier to build and is equivalent to the part shown in purple.

1) Determine the voltages and currents for the following 1/2 H-bridge for

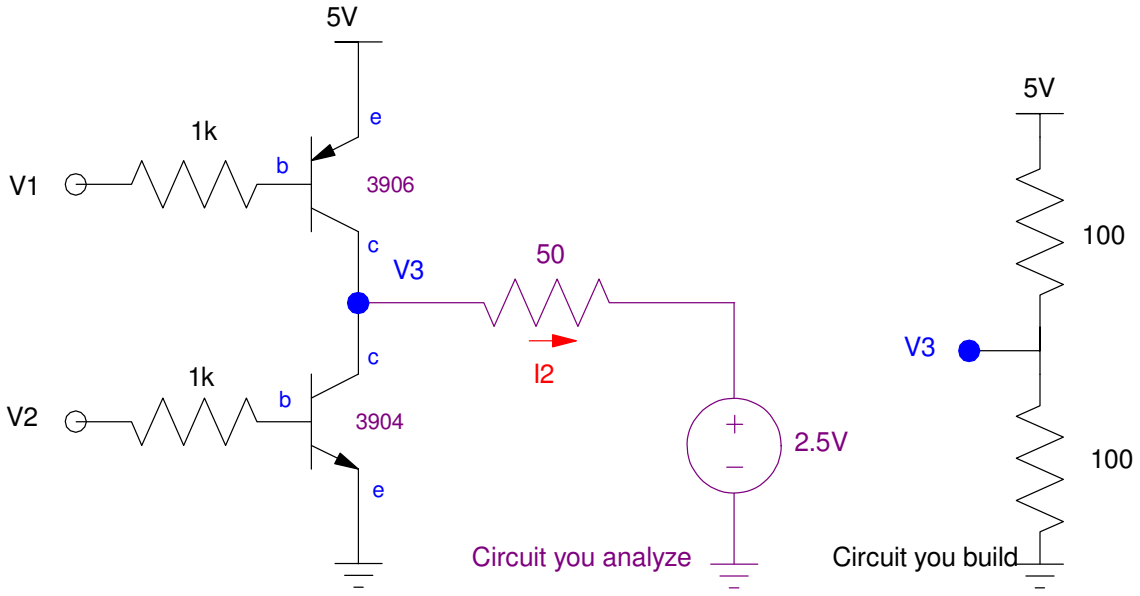
- V1 = 0V, V2 = 0V
- V1 = 5V, V2 = 5V
- V1 = 5V, V2 = 0V

Assume 3904/3906 transistors

- | Vbe | = 0.7V
- current gain = 100
- $V_{ce(sat)}$ = 0.2V

2) Check your results (votlages and currents) in CircuitLab

3) Lab: Build this circuit and measure the voltages and currents. (note: it's OK to compute the currents from the measured votlages).



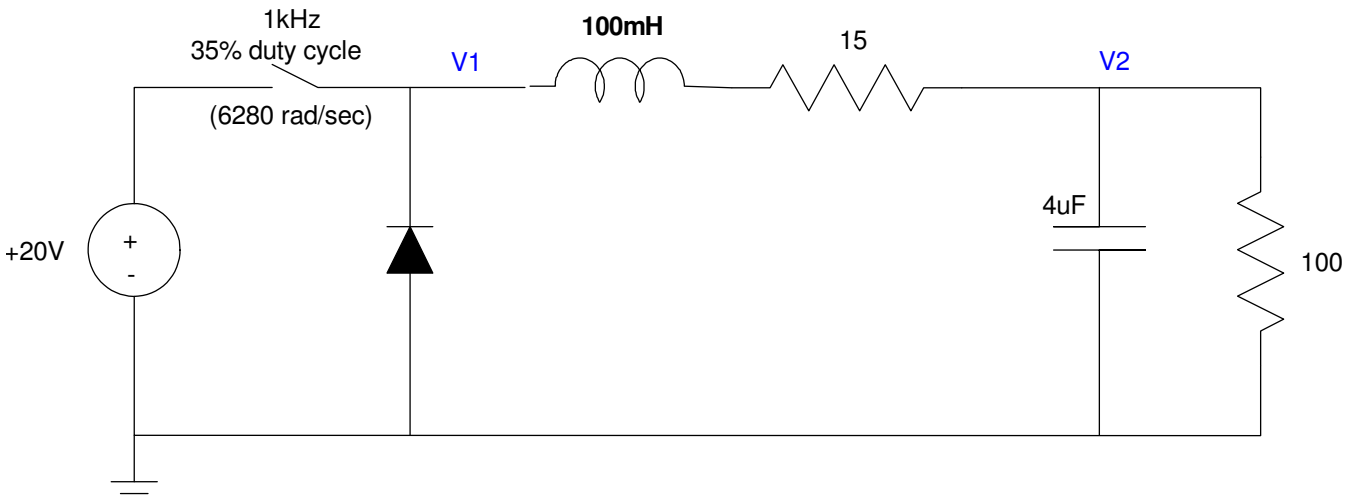
DC to DC Converters

4) Determine the voltages (both DC and AC) for V1 and V2.

5) Change the duty cycle and C so that

- The DC voltage at V2 = 5.00V
- The ripple at V2 is 100mVpp

6) Simulate the circuit for problem #5 in CircuitLab and determine V2 (DC and AC)



DC to DC Converter (problems 4 - 6)

Fourier Transforms

The voltage V1 in problem #4 is a 35% duty cycle square wave

$$V_1(t) = V_1(t + 1ms) \qquad \textit{V1 is periodic in 1ms - i.e. it's a 1kHz square wave}$$

$$V_1(t) = \begin{cases} +20V & 0 < t < 350\mu s \\ -0.7V & 350\mu s < t < 1000\mu s \end{cases}$$

7) Determine the first five terms for the Fourier transform for V1(t)

$$V_1(t) = a_0 + a_1\cos(\omega_0 t) + b_1\sin(\omega_0 t) + a_2\cos(2\omega_0 t) + b_2\sin(2\omega_0 t)$$

8) Determine V2(t) at each frequency

- DC
- 1kHz
- 2kHz

9) How do your answers for problem #1 and problem #8 compare?

	Problem #4	Problem #8
V2(DC)		
V2 1kHz term		
V2 2kHz term		