CE 3111.103

Lab 1: Introduction to PSpice

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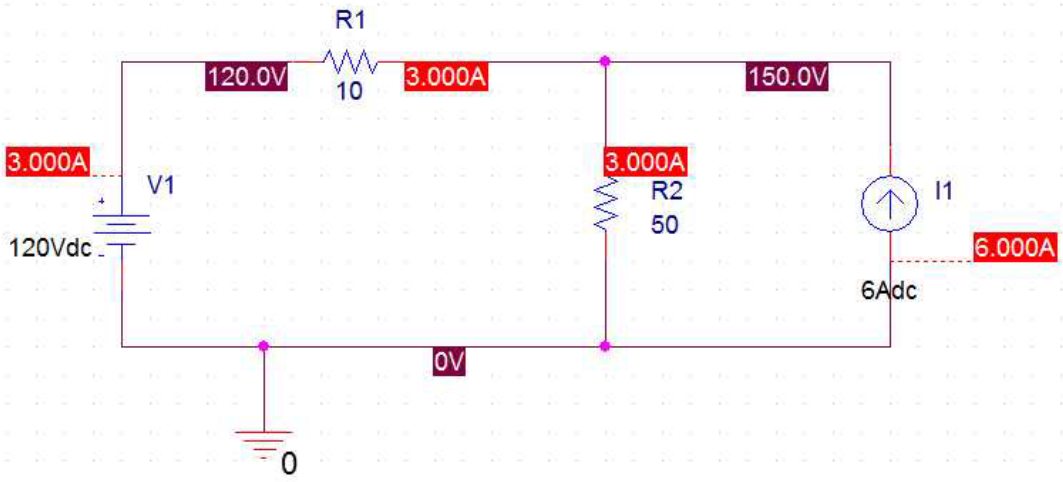
Objective

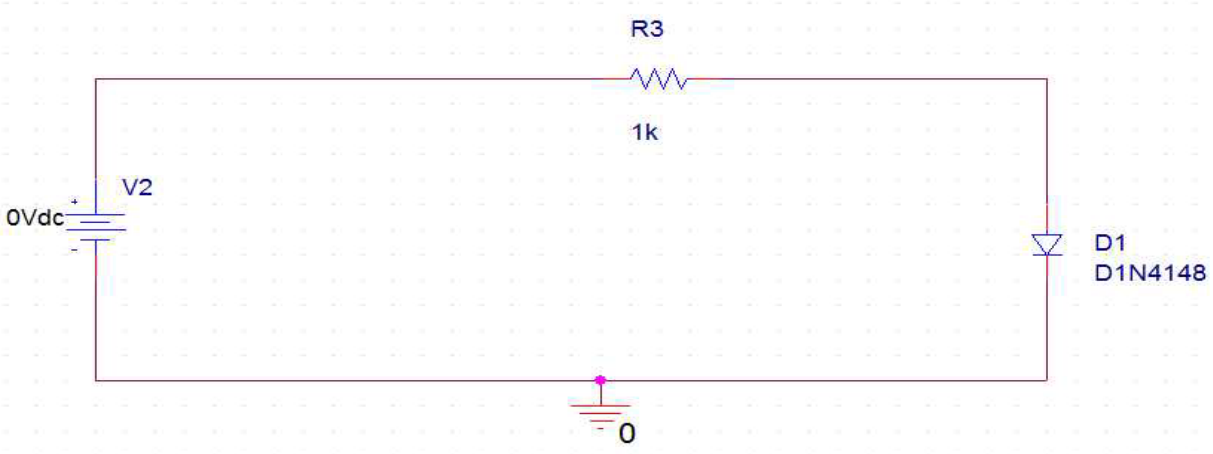
The primary purpose of this lab is to get familiar to PSpice and know how it can assist in analyzing circuits.

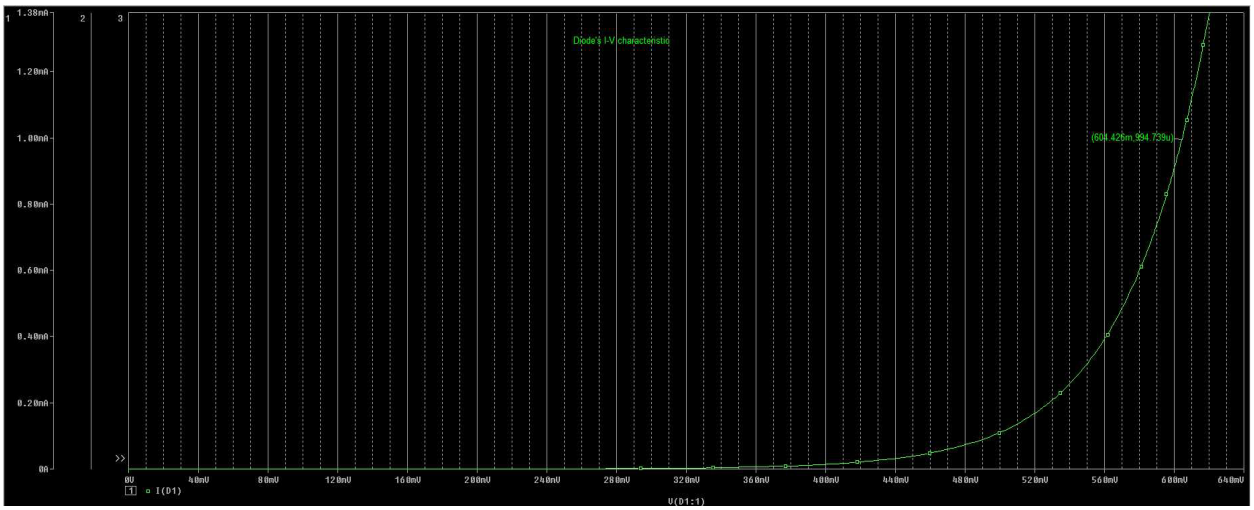
Simulation Results

- Bias point

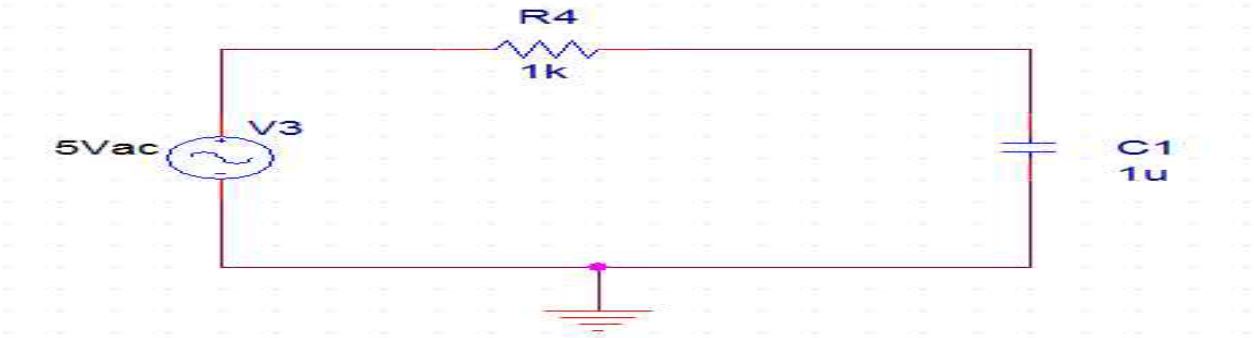


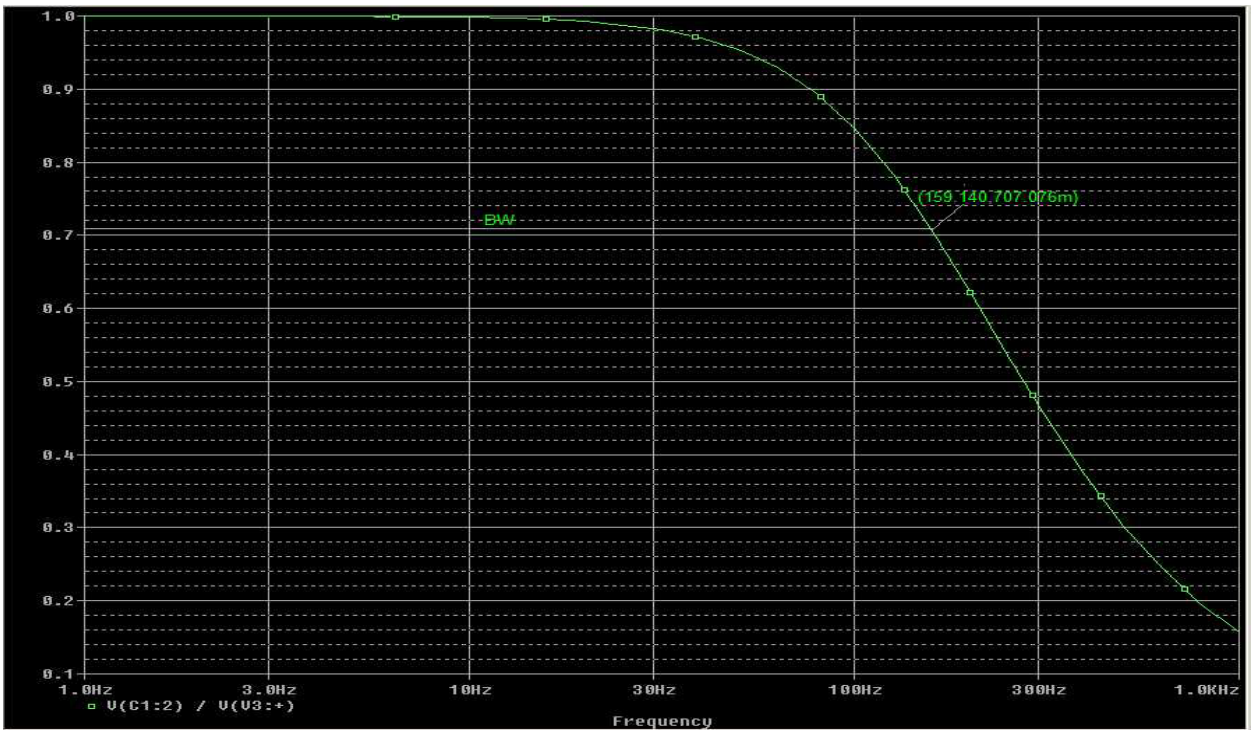
- DC Sweep



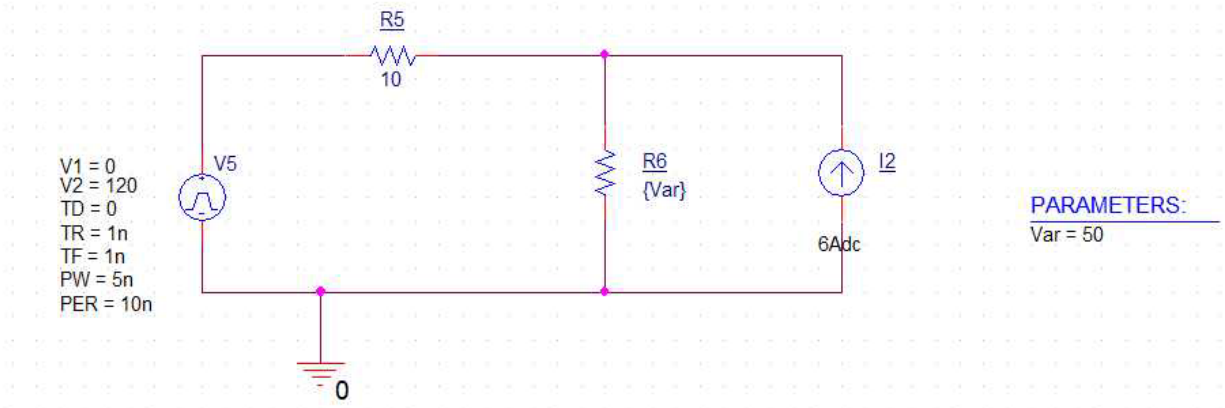

Diode's I-V characteristic
(604.426m,394.739u)
I(D1)
V(D1:1)

- AC Sweep

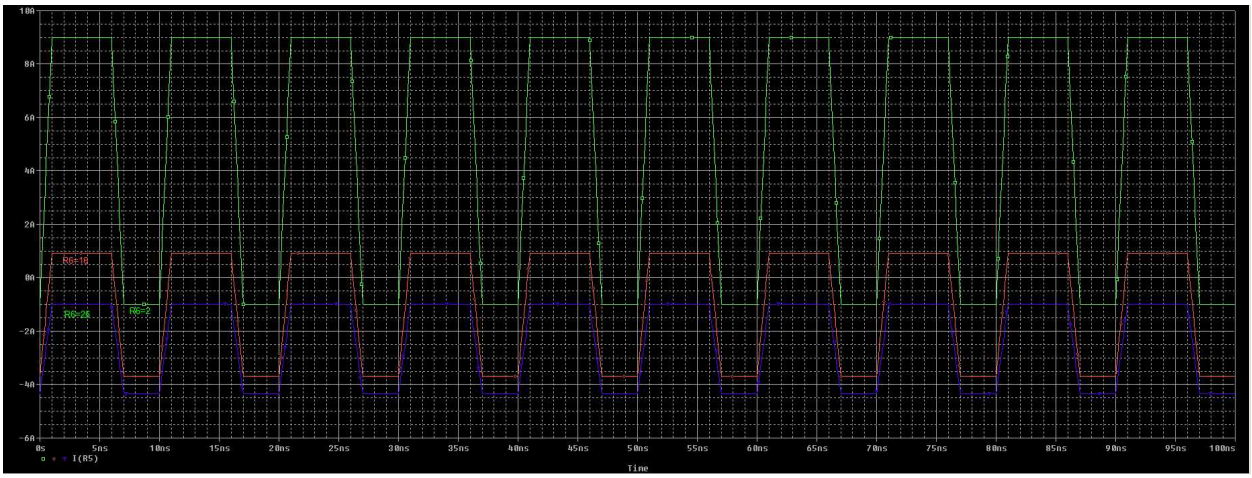

R4
1k
V3
5Vac
C1
1u


(159.140,707.076m)
BW
V(C1:2) / V(V3:+)
Frequency

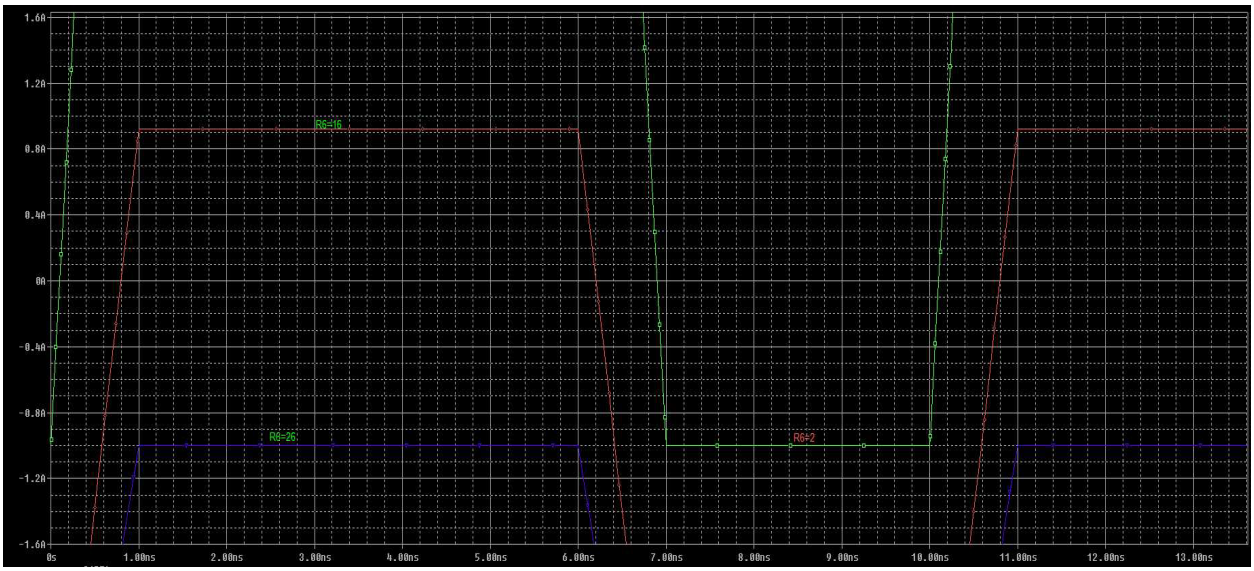
- Parametric sweep



Resistor values that makes R1 (R5 in the simulation) 1A:

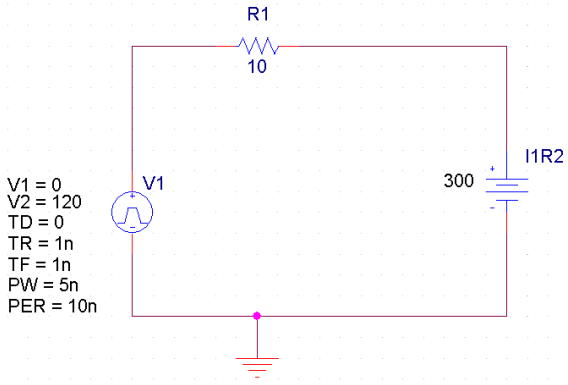


Close up: R2=16Ω,26Ω, or 2Ω



Thought Questions

1. The I-V characteristic shows that after a certain positive voltage, the diode turns on and allows current grows exponentially with the increasing voltage. Before the turn on voltage, the current is relatively constant.
2. The 3-dB point shows the lowest possible operational limit of the circuit. As the input frequency gets higher, the output gets weaker.
3. If the current direction in R1 is reversed, the solution will be affected. The original circuit can be converted to the following:



When V_1 = 0V, then V_1 is shorted, making the current source the only power source. In order to flow 1A through R1, R2 must adjust to 1.67Ω since $1\text{A} = \frac{6A \times R_2}{10\Omega}$.
When V_1 = 120V, then either the Voltage source must overpower the current source and R2, or the current source and R2 must overpower the voltage source to get 1A flow through R1. The direction of current change when one overpowers another. If the current flows clockwise, R2 should adjust to 18.33Ω since $1\text{A} = \frac{120V - 6A \times R_2}{10\Omega}$. If the current flows counter-clockwise, R1 should adjust to 21.67Ω since $-1\text{A} = \frac{120V - 6A \times R_2}{10\Omega}$.

Calculation/Comparison

V_1 = 0V, $1\text{A} = \frac{6A \times R_2}{10\Omega}$, R2=$\frac{10}{6} = 1.67\Omega$ (counter-clockwise)

V_1 = 120V, $1\text{A} = \frac{120V - 6A \times R_2}{10\Omega}$=18.33 Ω(clockwise)

V_1 = 120V, $-1\text{A} = \frac{120V - 6A \times R_2}{10\Omega}$=21.67 Ω (counter-clockwise)

V1(V)	Calculated result R2(Ω)	PSpice Result R2 (Ω)	Error
0	1.67	2	19.76%
120	18.33	16	14.56%
120	21.67	26	19.98%

Conclusion

The calculated resistance of R2 in parametric sweep is close to the experimented result, but does not match precisely. The reason for error may be the step value between each test R2 value is too big. For other sweep, the results are reasonable.