

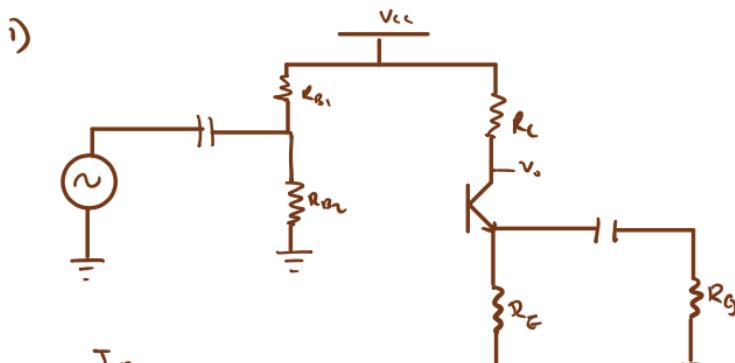
# Pre-Lab 8: BJT Amplifier Configurations

ECEN 325 - 511

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Due Date: November 2, 2021

## Calculations



$$N = \frac{I_{R_{B1}}}{I_B}$$

$$V_{RE} = 1V$$

$$V_{RC} = V_{cc} - V_o - R_C \cdot I_C$$

$$I_C \leq \frac{B}{R_i} \cdot \frac{1}{\frac{w}{V_{BE} + 0.7} + \frac{w}{V_{cc} - V_{RE} - 0.7} + \frac{A_u}{w R_L}}$$

$$\approx 2.8 \text{ mA}$$

$$R_C = \frac{V_{RE}}{I_C} = 1k\Omega$$

$$R_{B1} = \frac{B(V_{cc} - V_{RE} - 0.7)}{w I_C}$$

$$R_E = \frac{V_{RE}}{I_C} = 357.14 \Omega$$

$$R_{B2} = \frac{(V_{RE} + 0.7) (1)}{w R_L}$$

$$R_{B1} = 11.785 k\Omega$$

$$R_{B2} = 6.07 k\Omega$$

$$R_E = \frac{R_L}{|A_v|} = V_T = \frac{1k\Omega}{25} = 40 \Omega$$

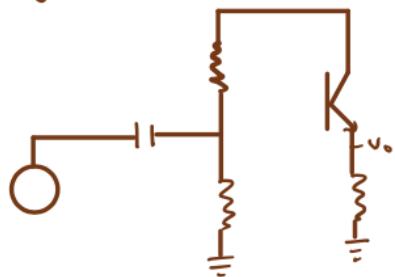
$$R_E = V_T / I_C \quad \text{Thermal Voltage } V_T = 25 \text{ mV}$$

$$R_E = 25 \text{ mV} / 2 = 12.5 \text{ mV}$$

$$R_E = \frac{1k\Omega}{25} = 40 \Omega = 31.07 \Omega$$

$R_{B1} = 11.785 k\Omega$ $R_{B2} = 6.07 k\Omega$ $R_E = 31.07 \Omega$ $R_C = 40 \Omega$ $R_E = 357.14 \Omega$
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2) Figure 6



$$V_{R_{B2}} = \frac{R_{B2}}{R_{B1} + R_{B2}} V_{cc} = 1.7V$$

$$V_{RE} = V_{RB2} - 0.7 \approx 1V$$

$$I_E = V_{RE} / R_E = 2.8mA$$

$$r_e = \frac{V_C}{I_C} = \frac{25mV}{2.8mA} = 8.92k\Omega$$

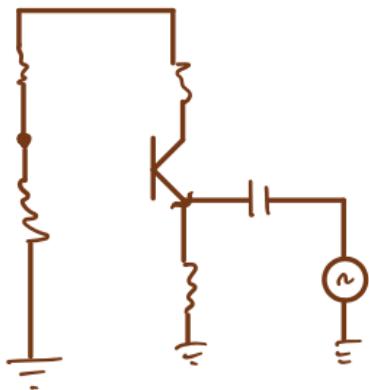
$$|AV| = \frac{R_E}{R_C + R_E} = \frac{332.14\Omega}{8.92k\Omega + 332.14\Omega} = .9756$$

$$R_i = R_{B1} || R_{B2} || (\beta + 1)(r_e + R_E) = 3614.7\Omega$$

$$R_o = R_E || r_C = 8.71\Omega$$

$A_V = .9756$
$R_i = 3614.7$
$R_o = 8.71$

3) Figure 8



$$R_{B1} = 11.785 \text{ k}\Omega$$

$$R_{B2} = 6.07 \text{ k}\Omega$$

$$R_L = 1\text{k}\Omega$$

$$R_E = 357.16 \text{ }\mu\Omega$$

$$V_{RB2} = 1.7 \text{ V}$$

$$V_{RE} = 1 \text{ V}$$

$$I_A = 2.8 \text{ mA}$$

$$A_V = \frac{R_E}{r_e} \quad r_e = 25 \text{ mV} / 2.8 \text{ mA} = 8.928 \text{ }\Omega$$

$$A_V = \frac{1 \text{ k}\Omega}{8.928} = 112.01$$

$$R_i = R_E \parallel r_e = 8.71 \text{ }\Omega$$

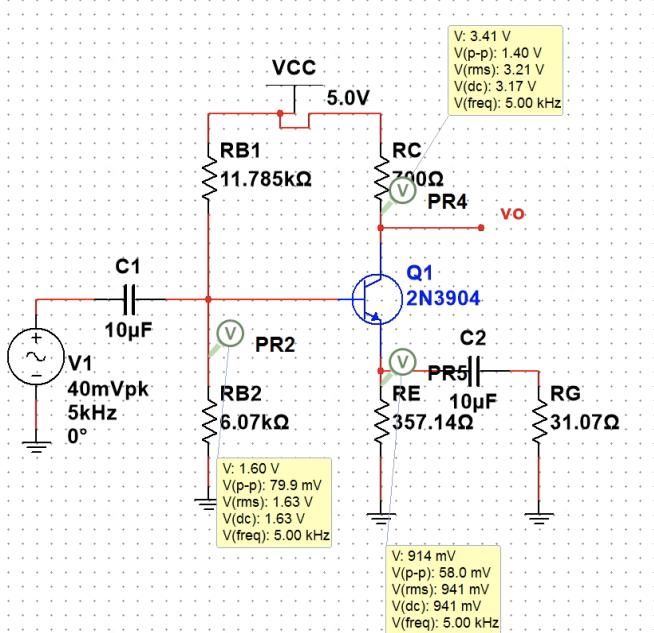
$$R_o = 1\text{k}\Omega$$

$A_V = 112.01$
$R_i = 8.71$
$R_o = 1\text{k}$

## Simulations (on Multisim)

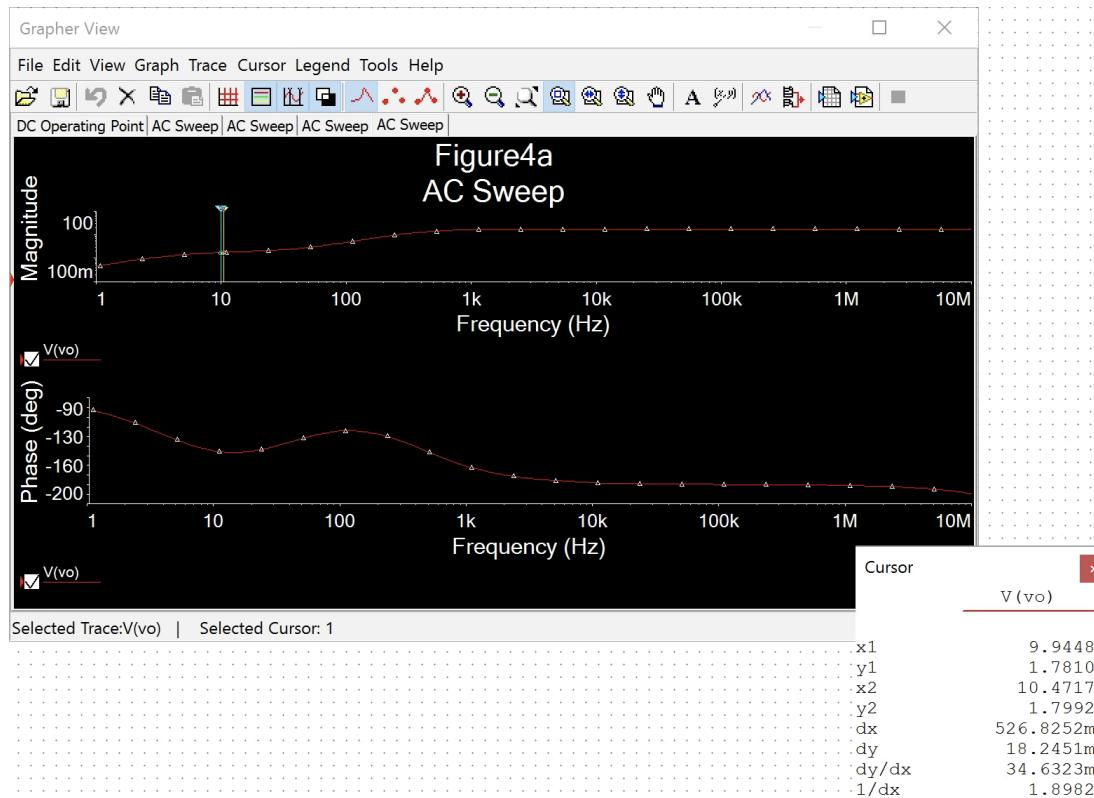
**Figure 4a**

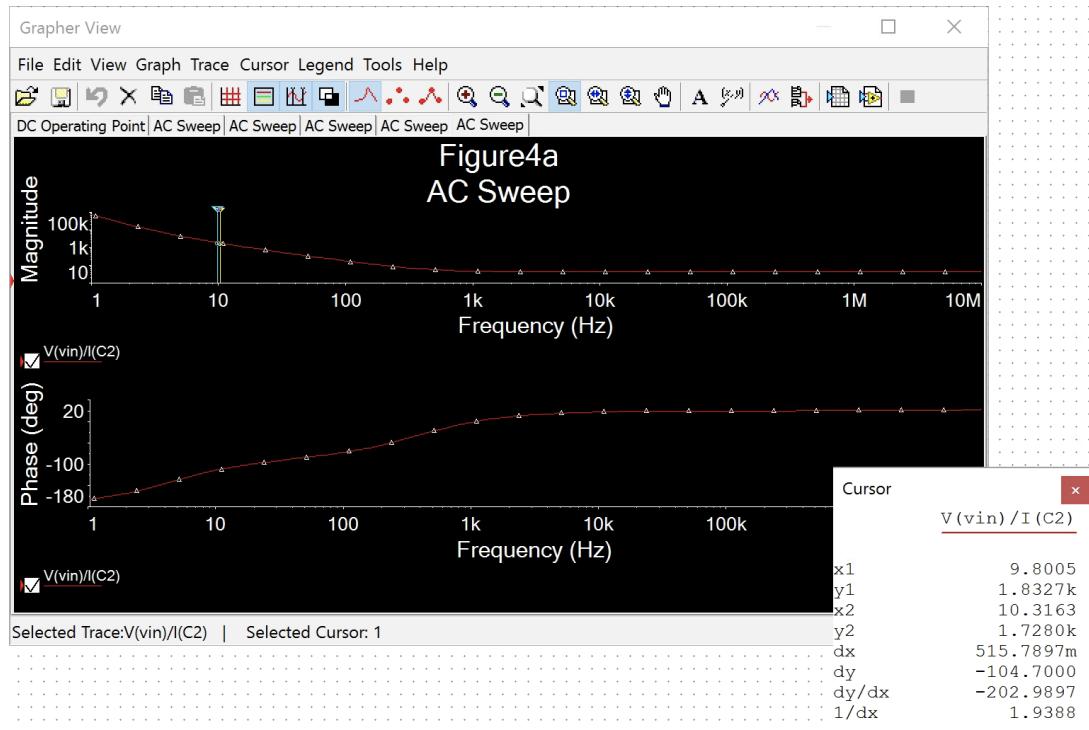
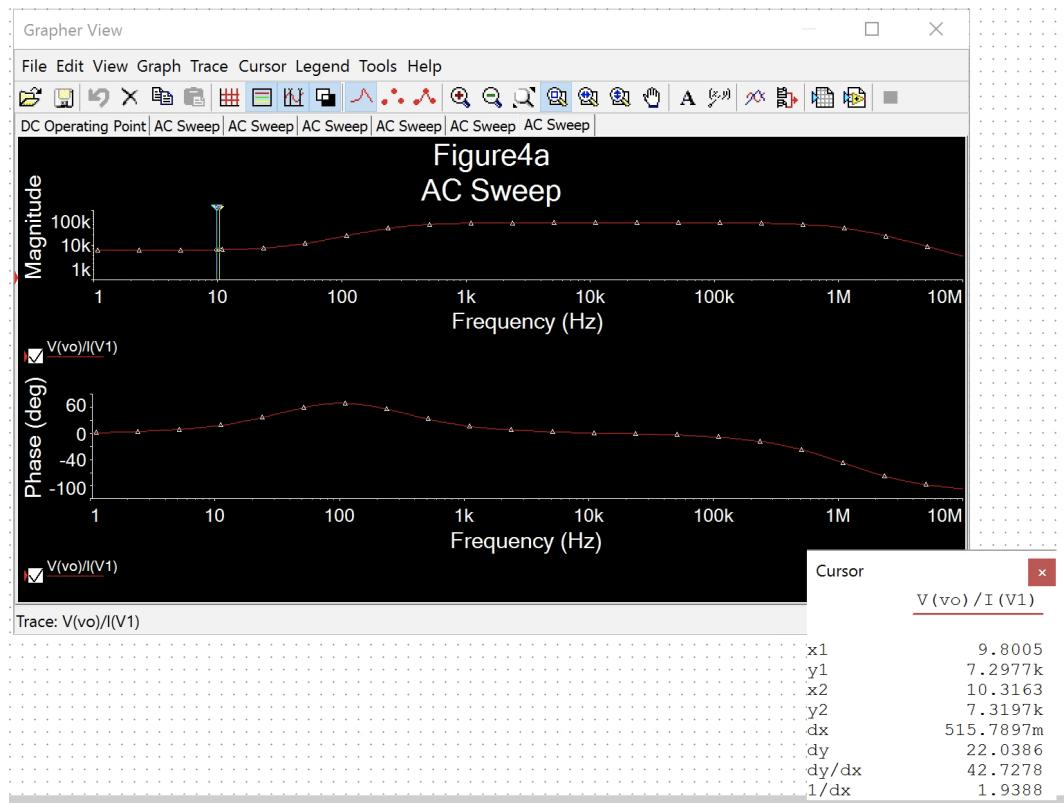
**Schematic / DC operating point 4a**



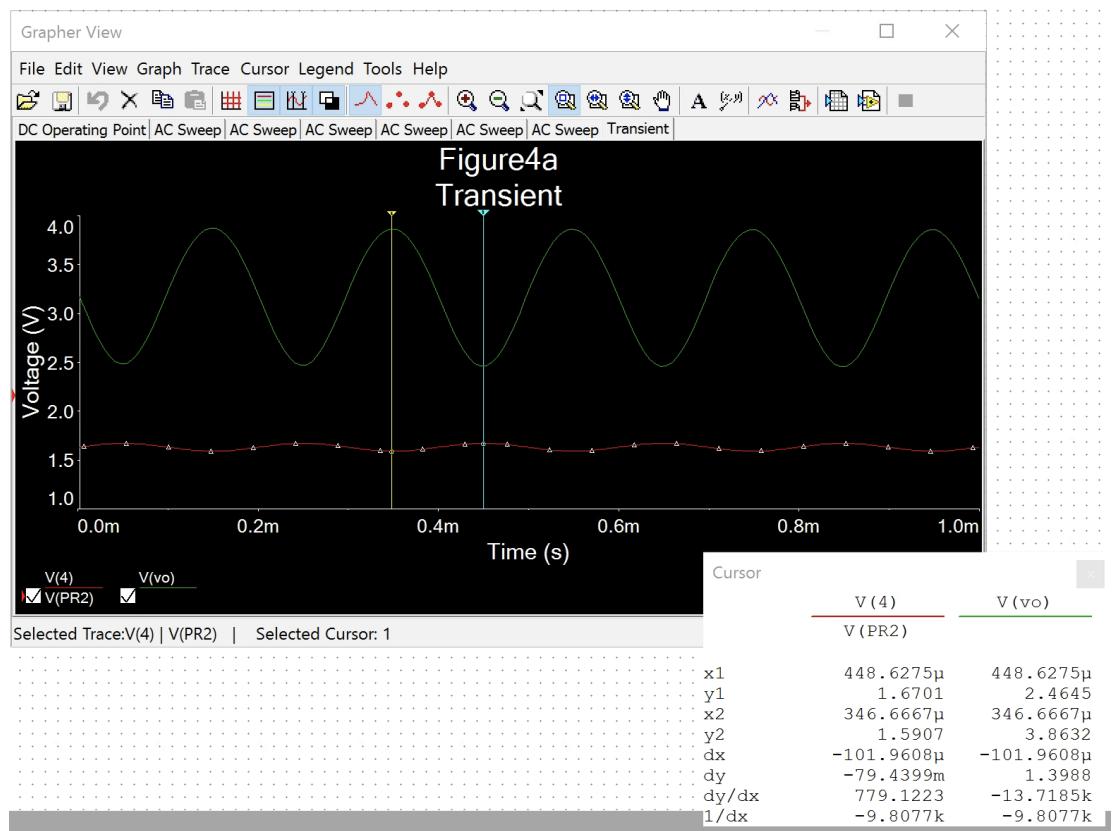
**AC simulation 4a**

$A_v$

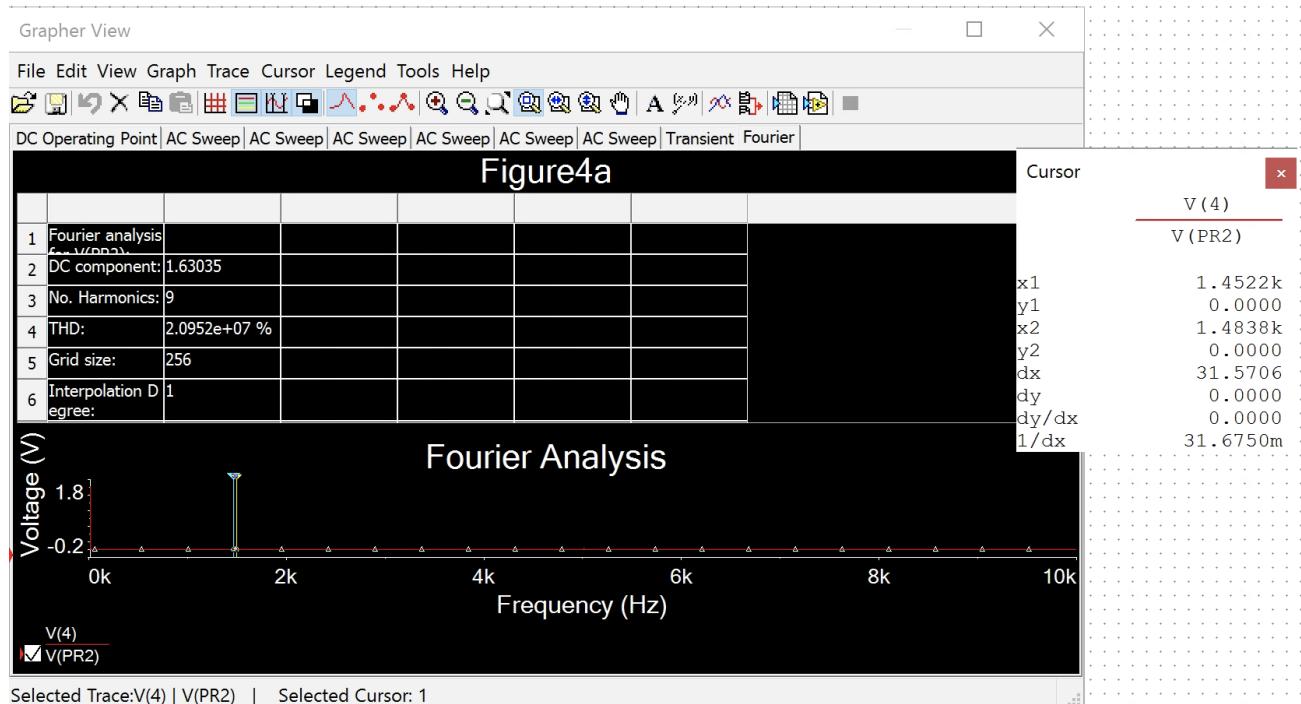


$R_i$  $R_o$ 

### Transient Simulation 4a

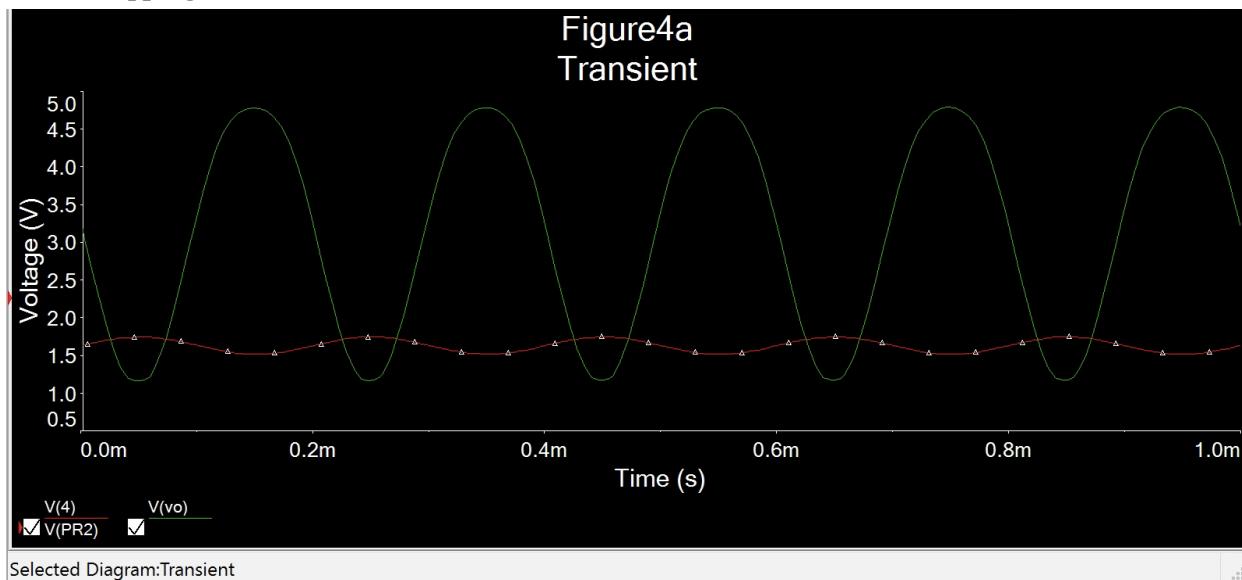


### Fourier Simulation 4a



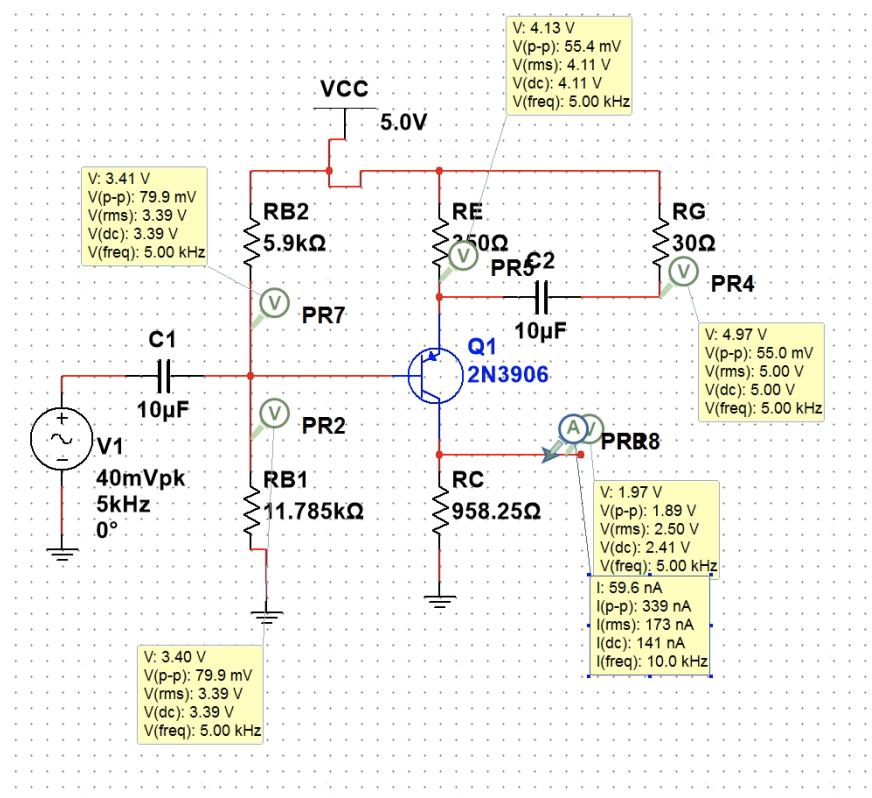
**Clipping 4a**

*Clipping at 115mV*



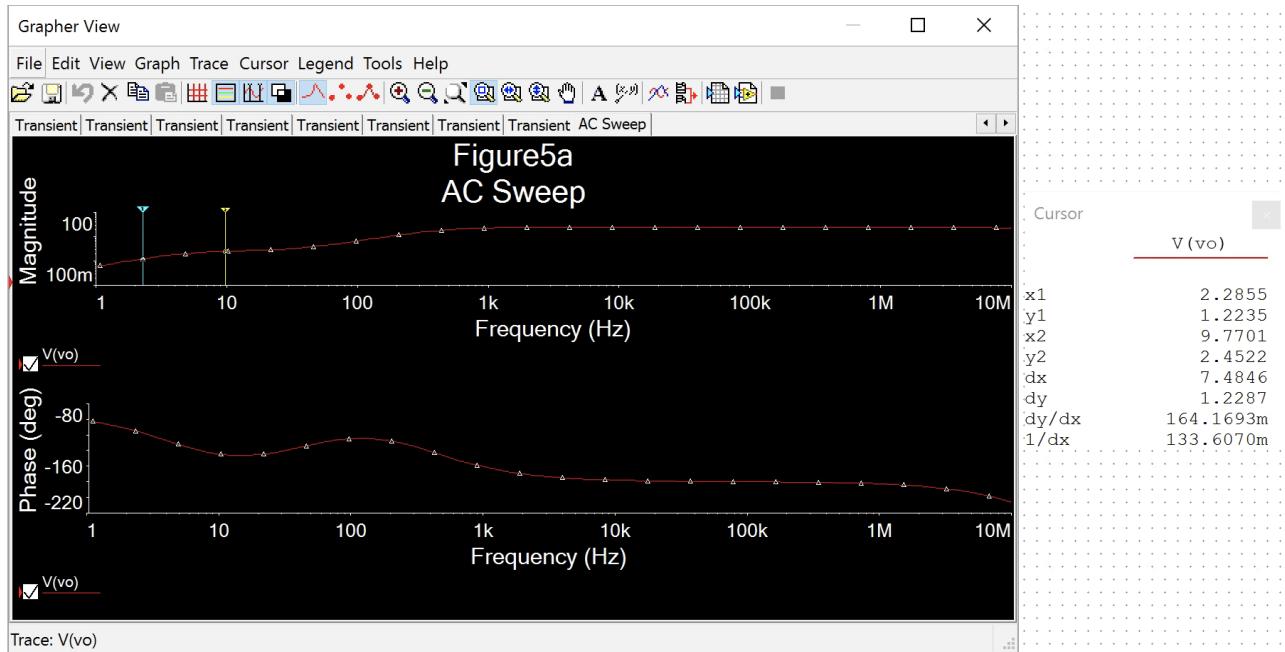
**Figure 5a**

*Schematic/ DC operating point 5a*

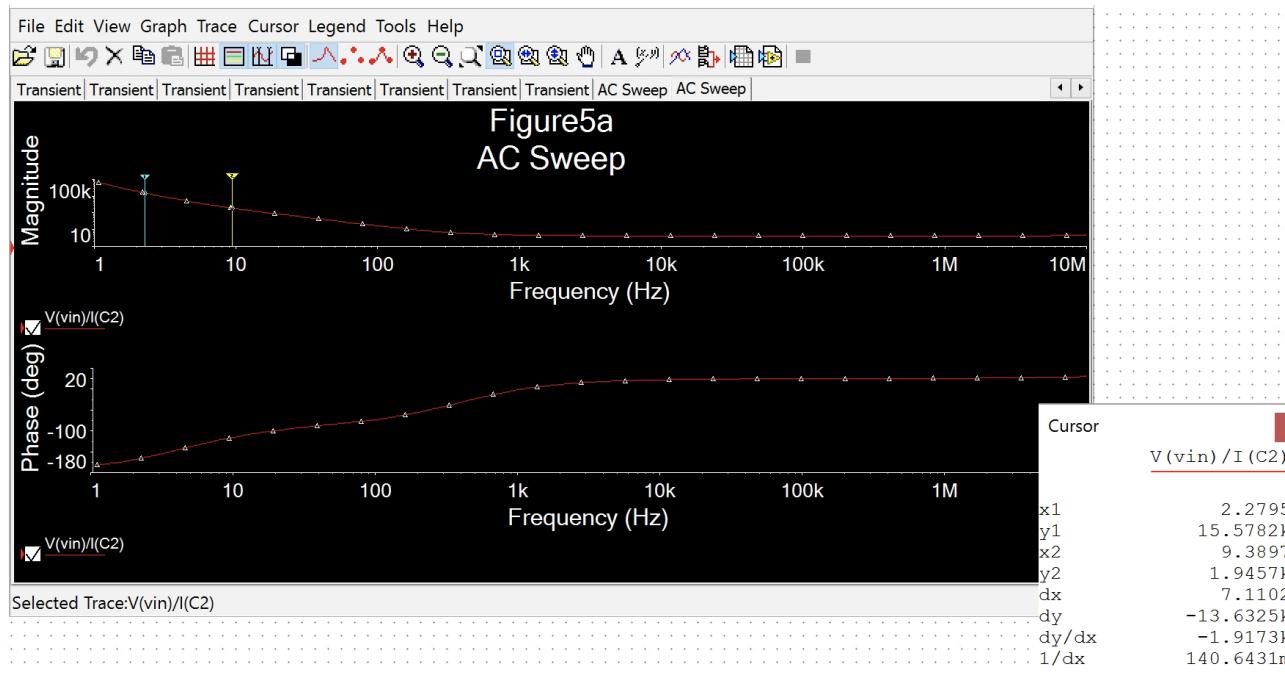


### AC simulation 5a

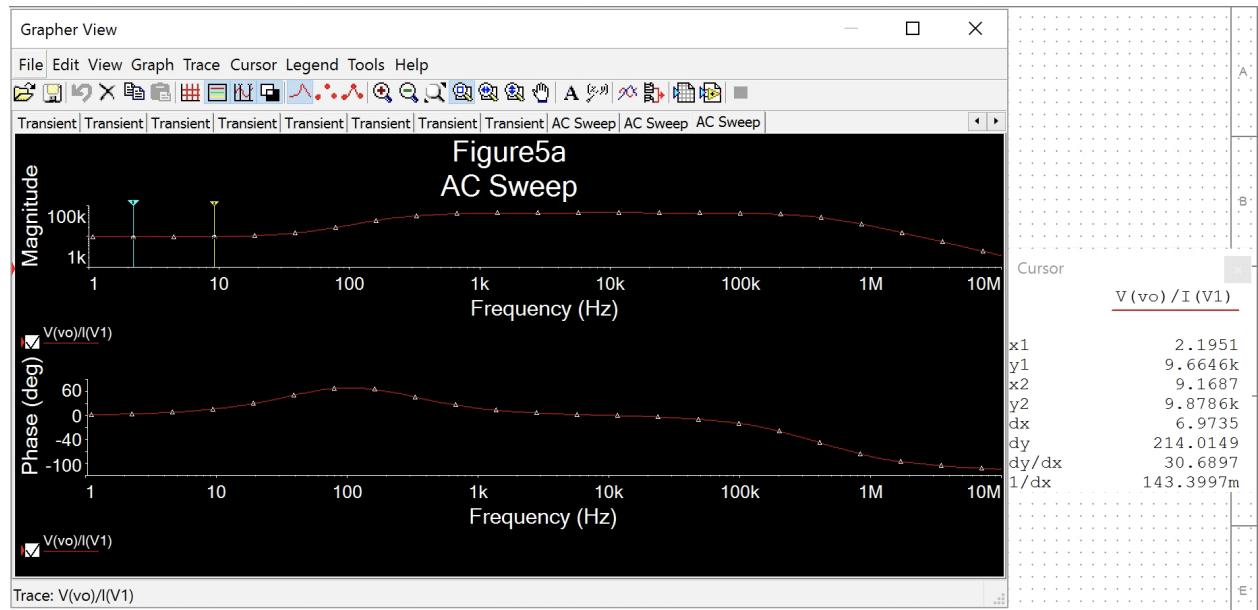
$A_V$



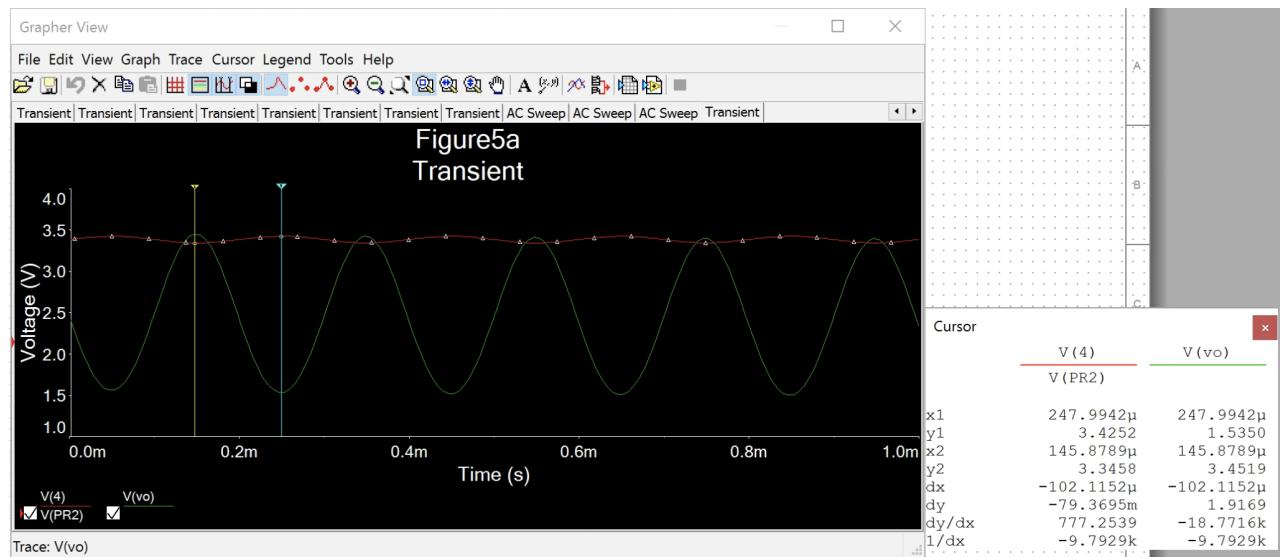
$R_i$



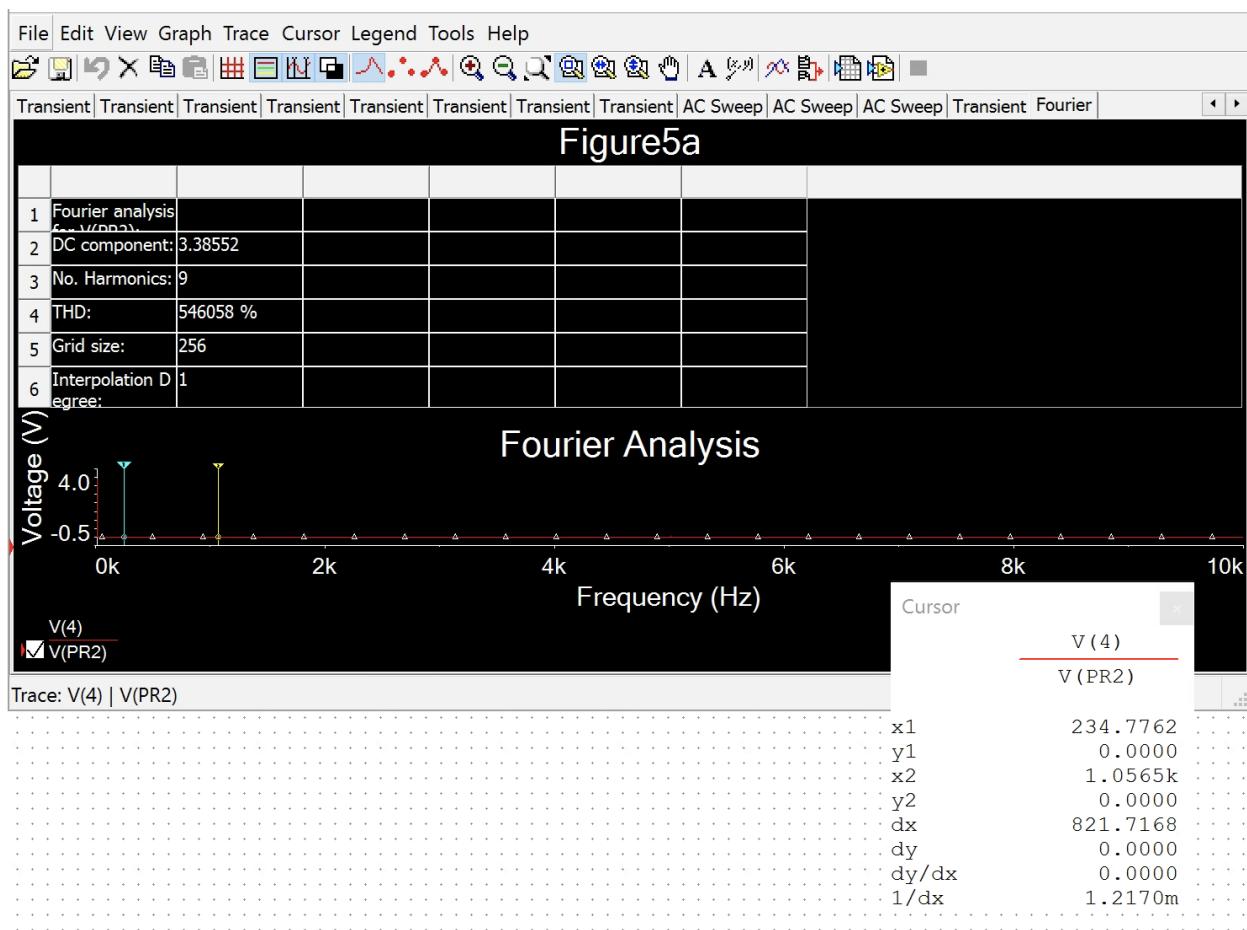
$R_o$



### Transient Simulation 5a

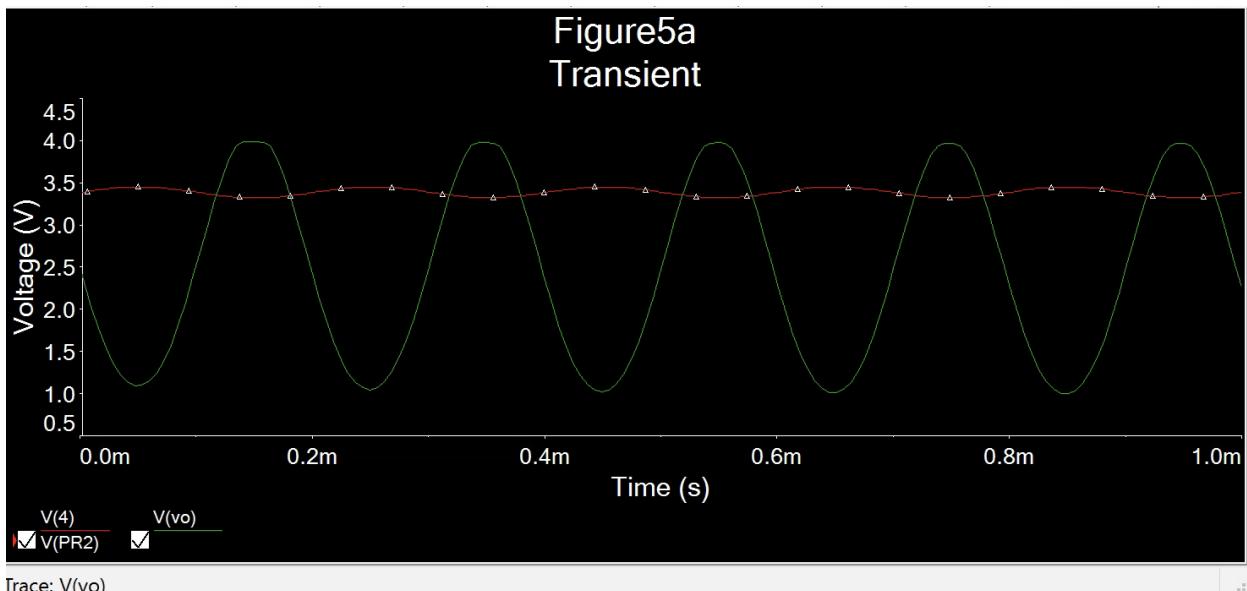


### Fourier Simulation 5a

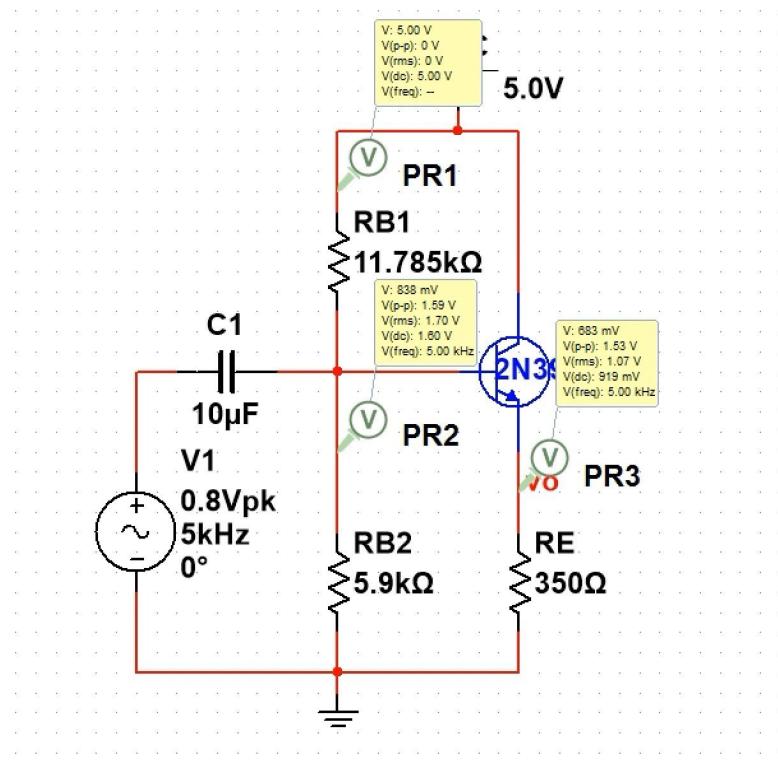


### Clipping 5a

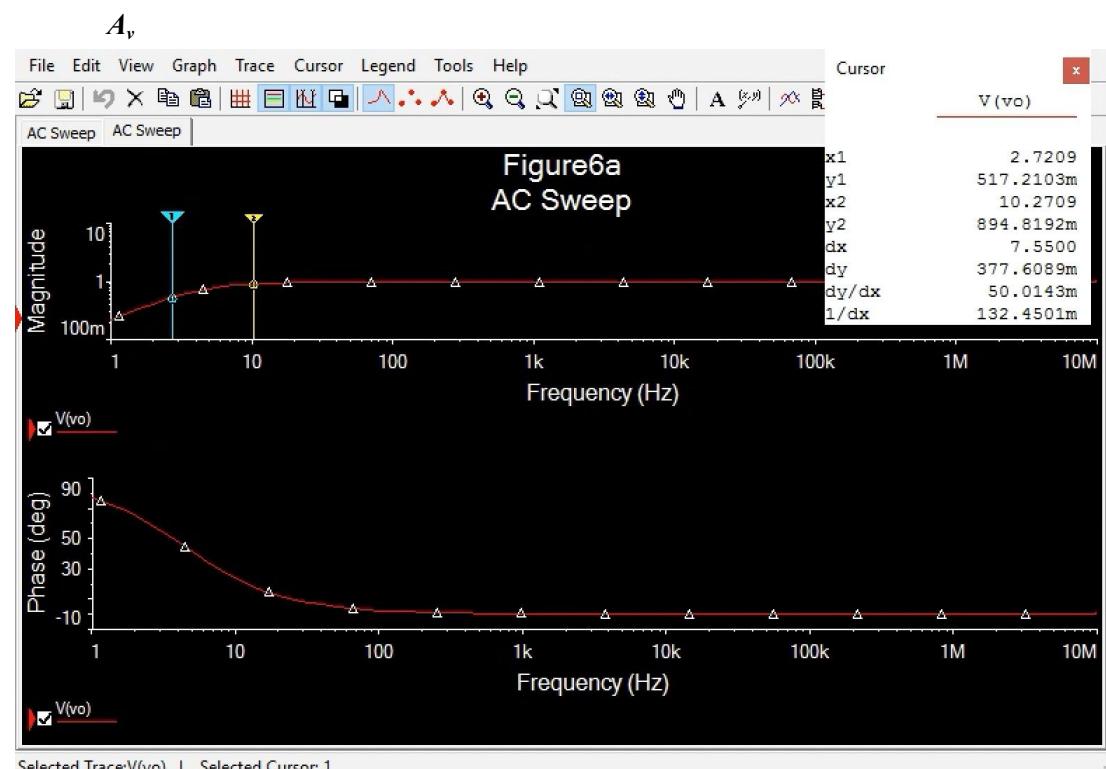
Clipping at 65 mV

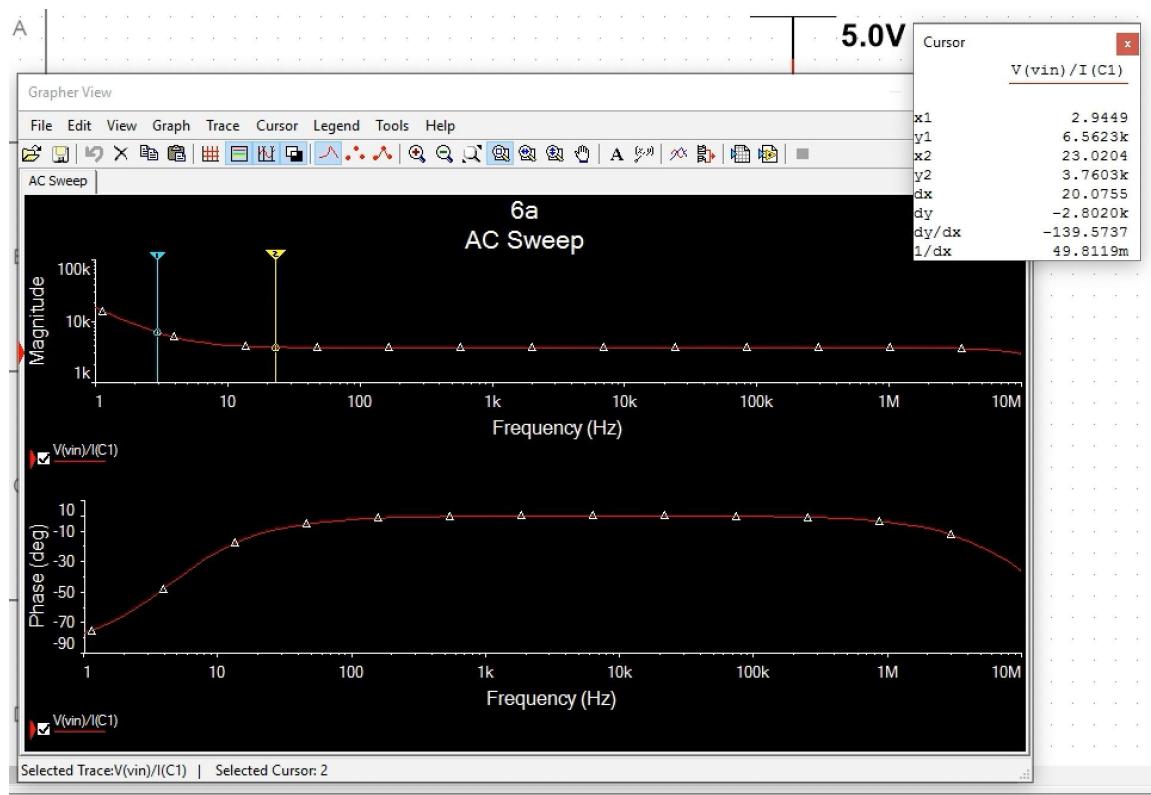
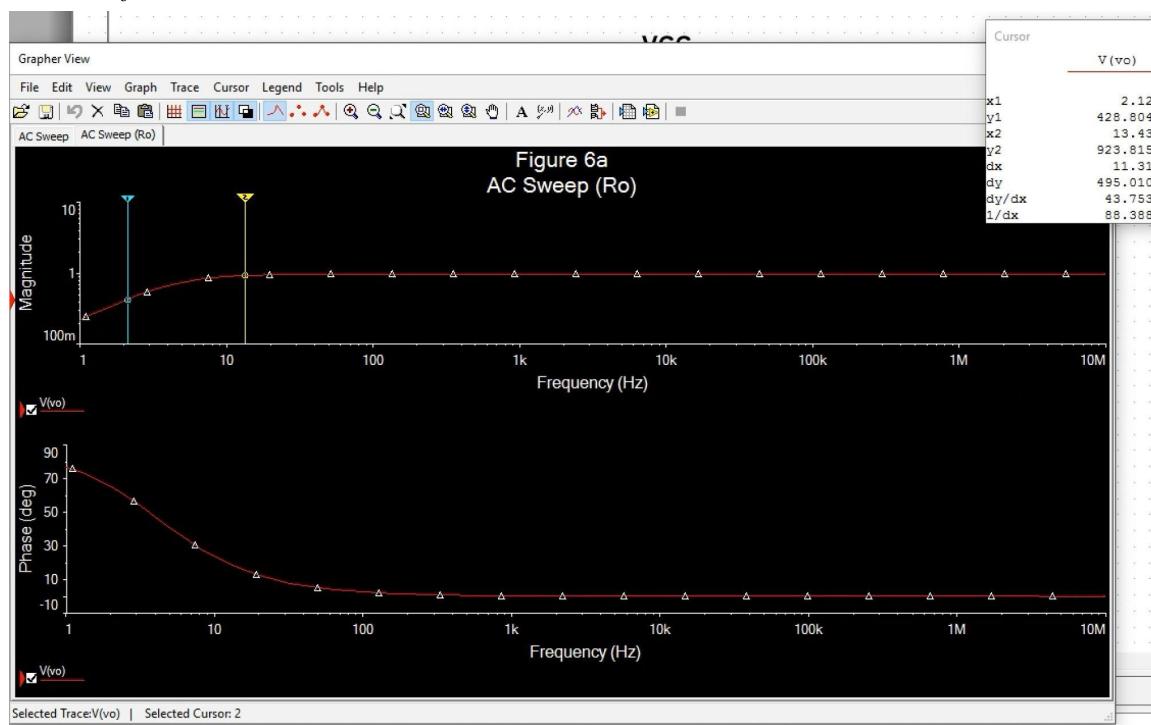


**Figure 6a**  
**Schematic/DC operating point 6a**

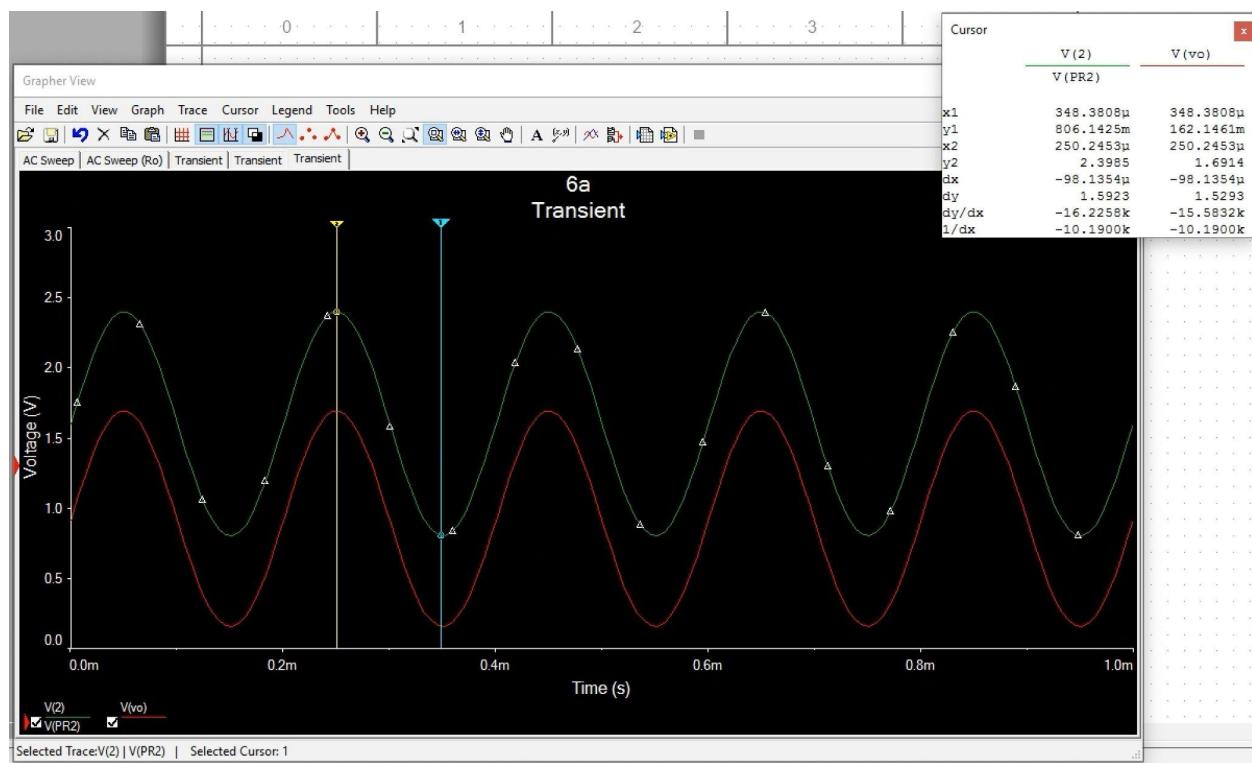


**AC simulation 6a**

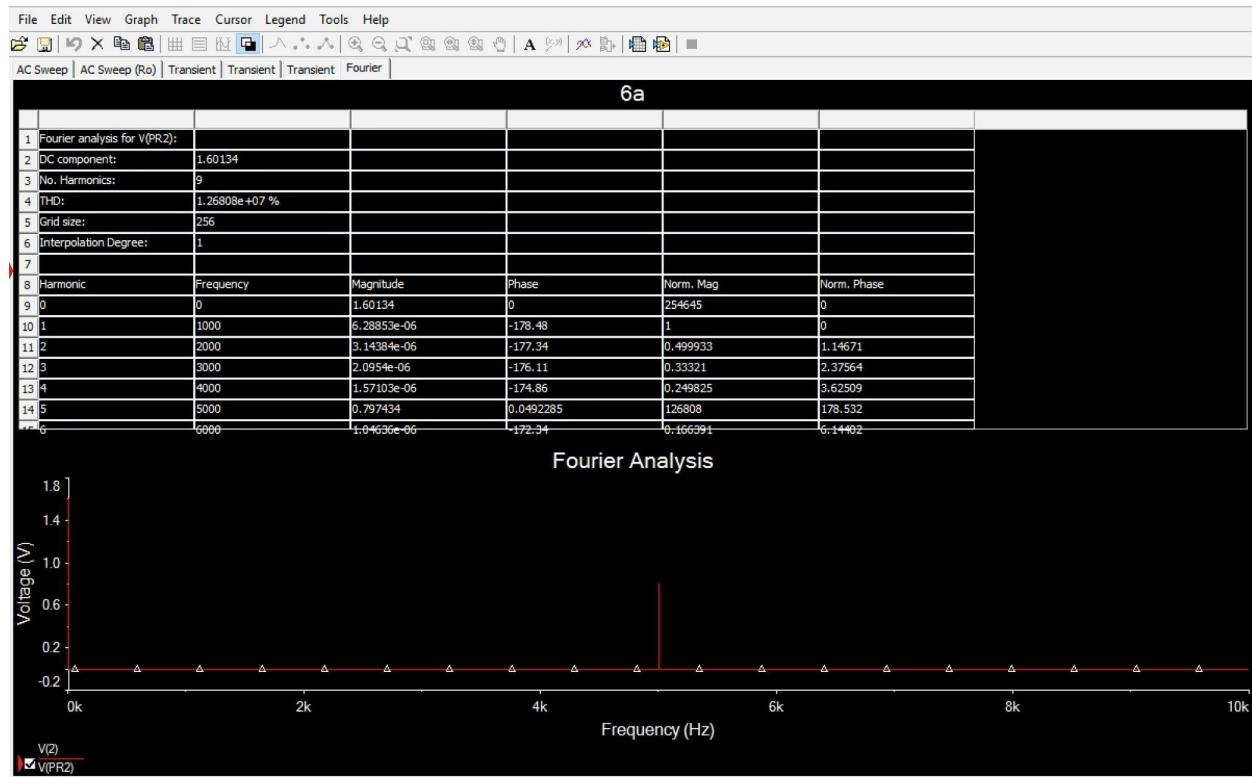


$R_i$  $R_o$ 

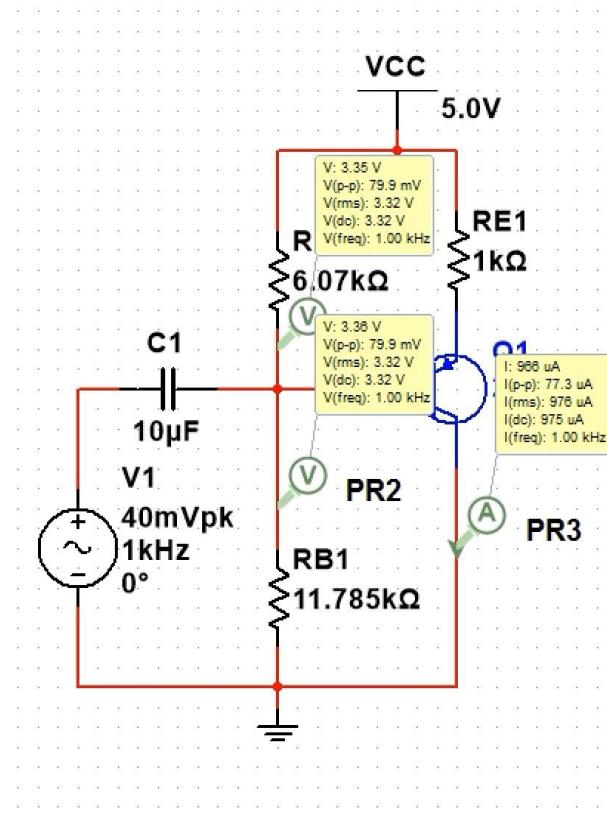
### Transient Simulation 6a



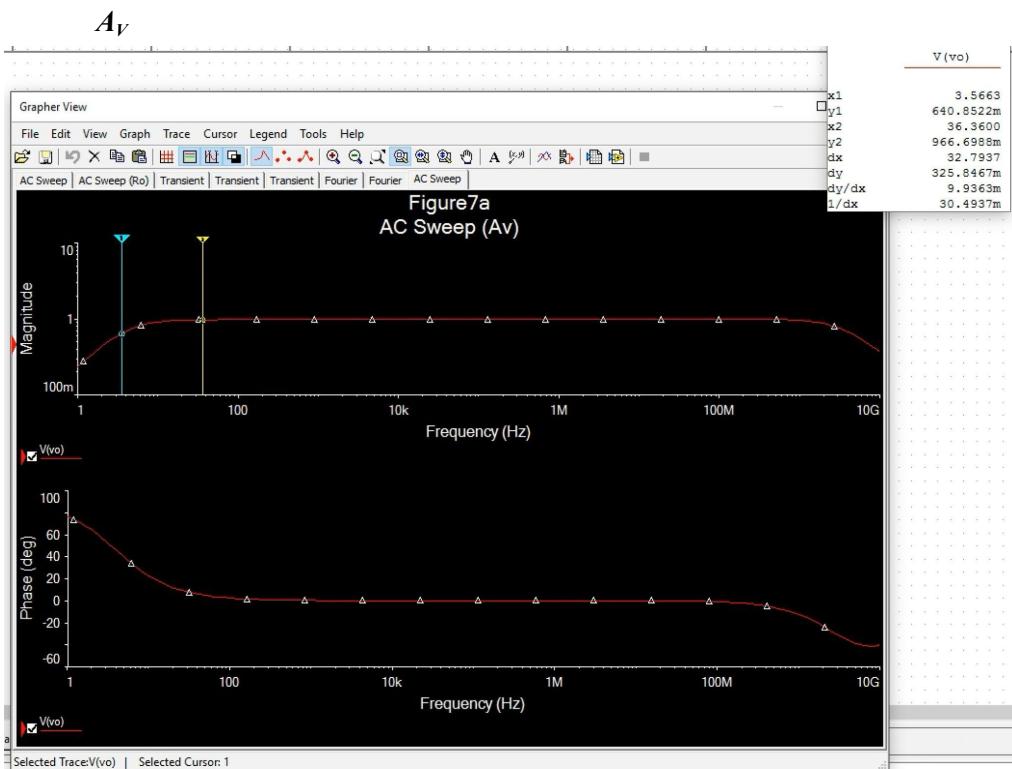
### Fourier Simulation 6a

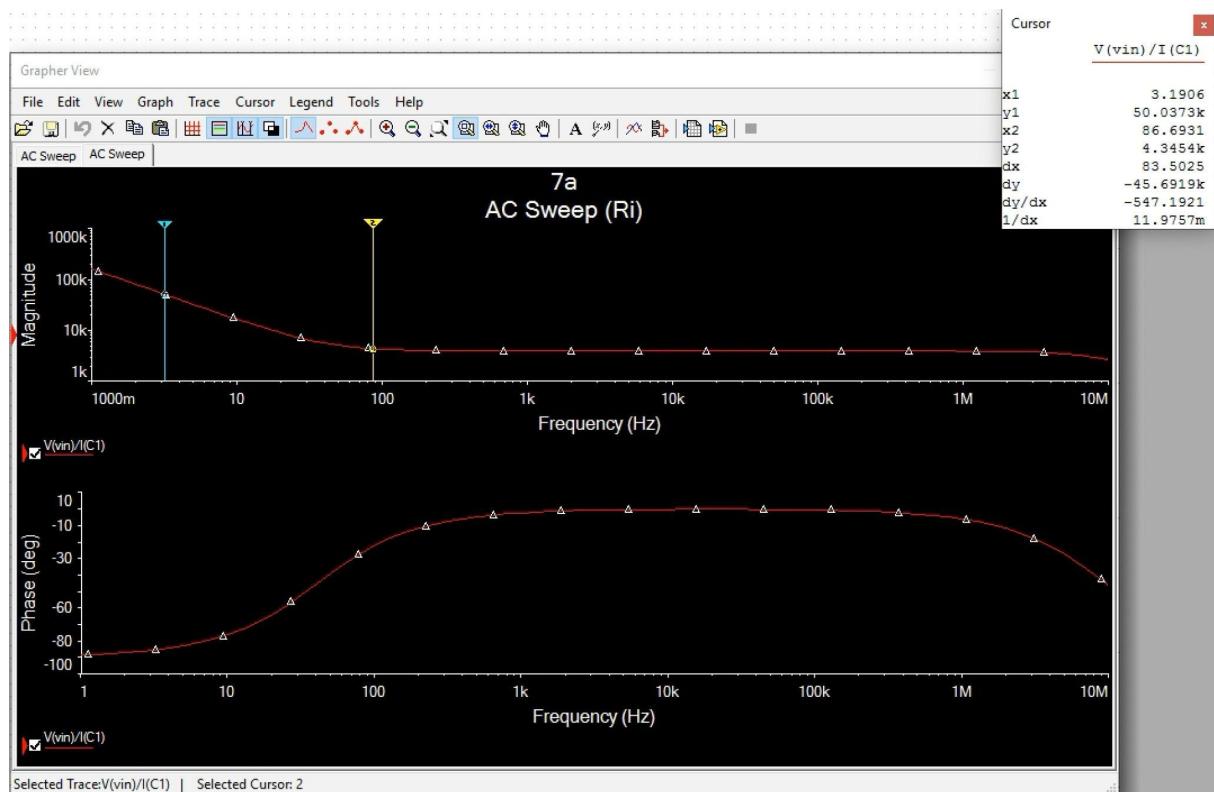
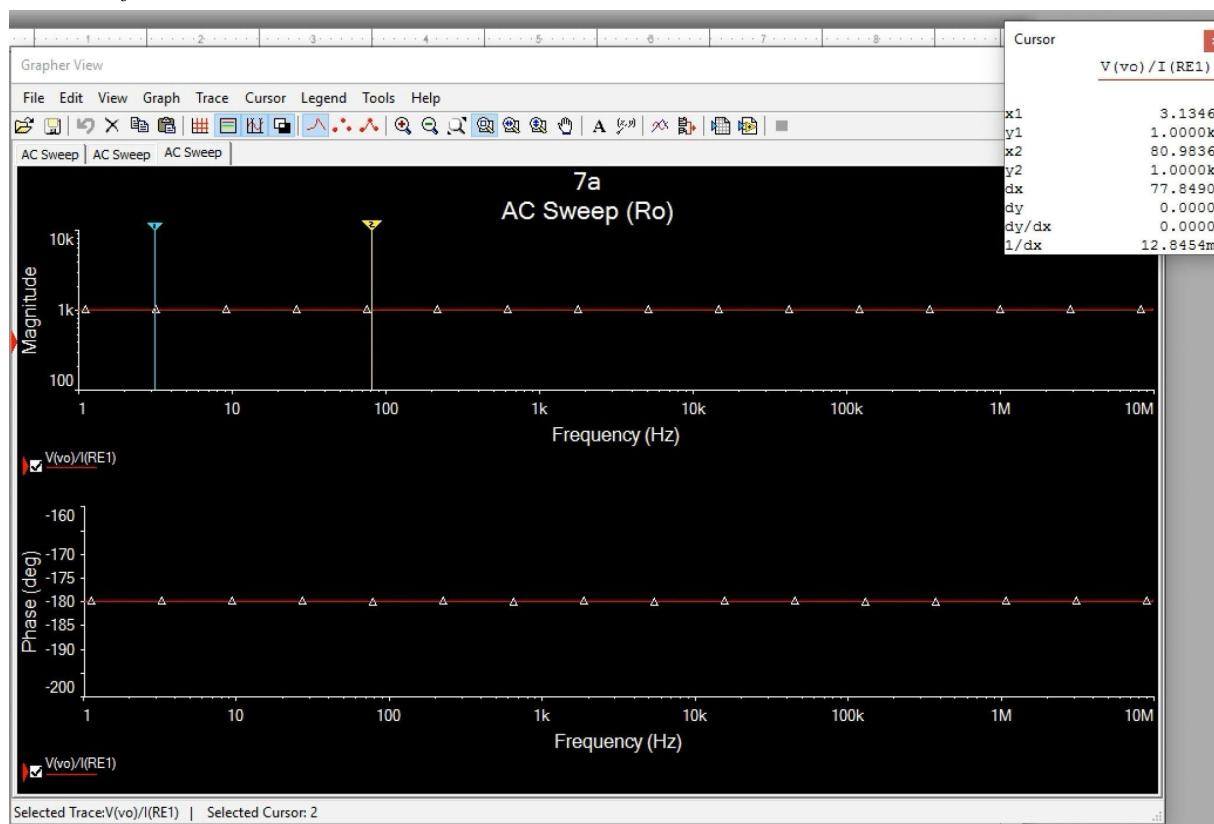


**Figure 7a**  
**Schematic/ DC operating point 7a**

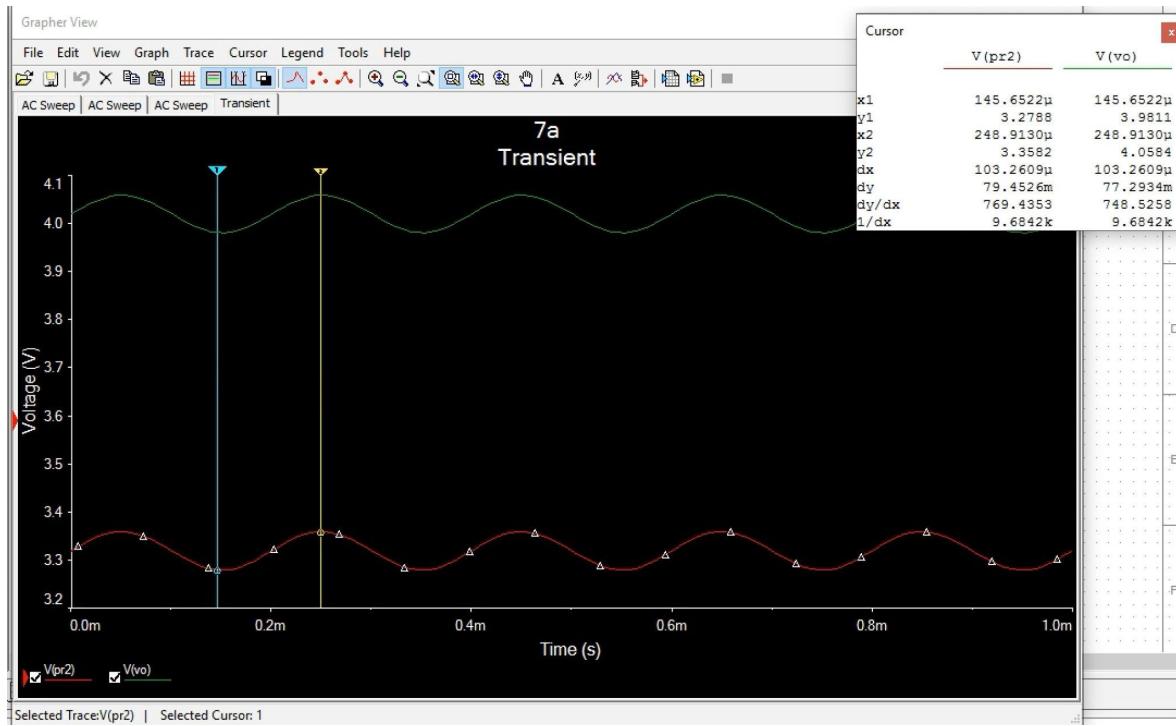


**AC simulation 7a**

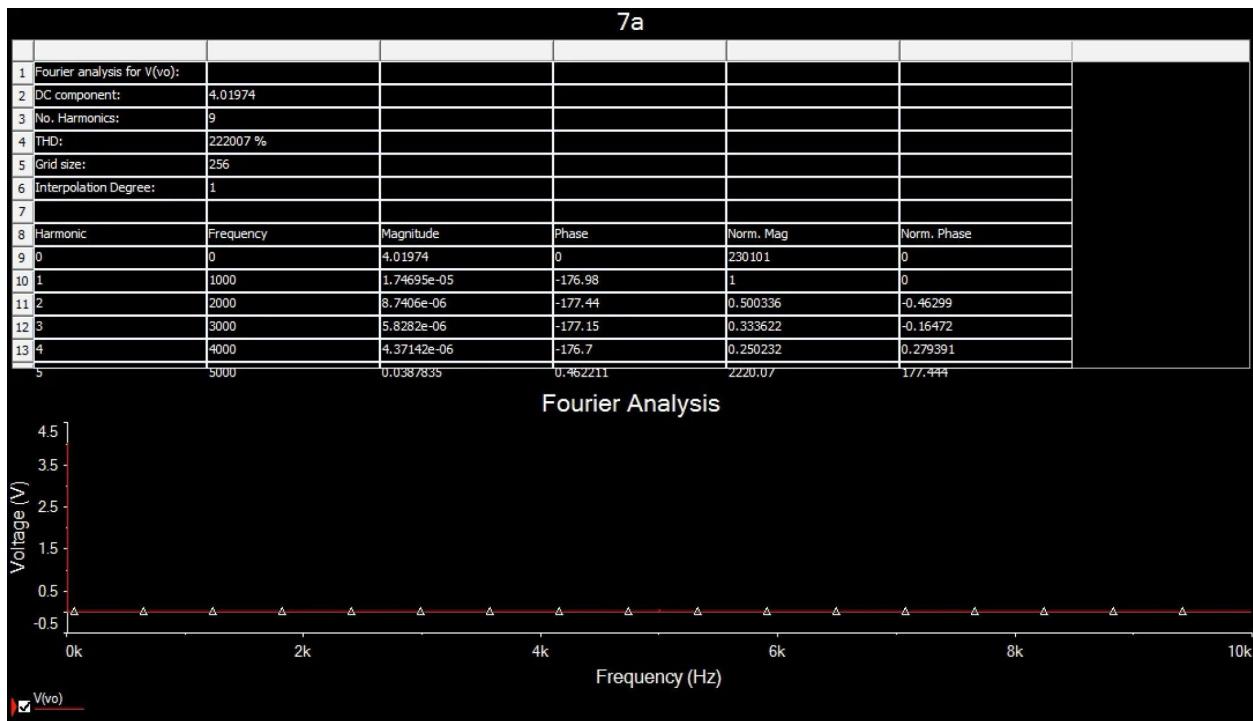


$R_i$  $R_o$ 

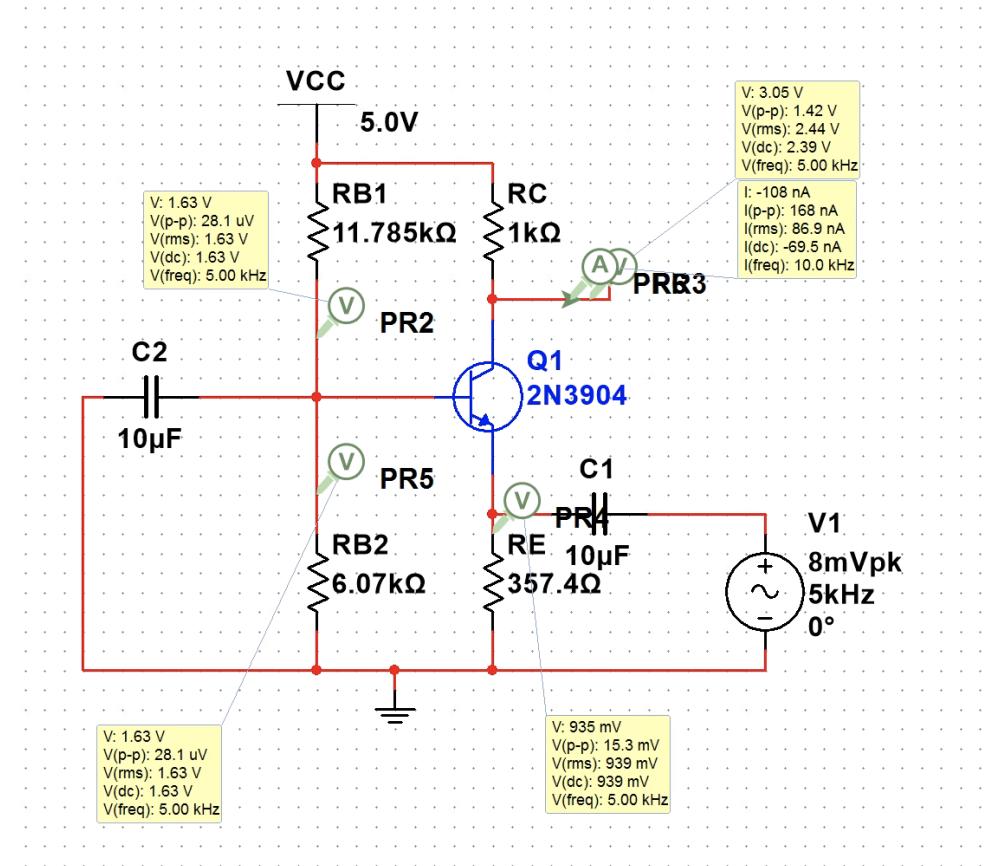
### Transient Simulation 7a



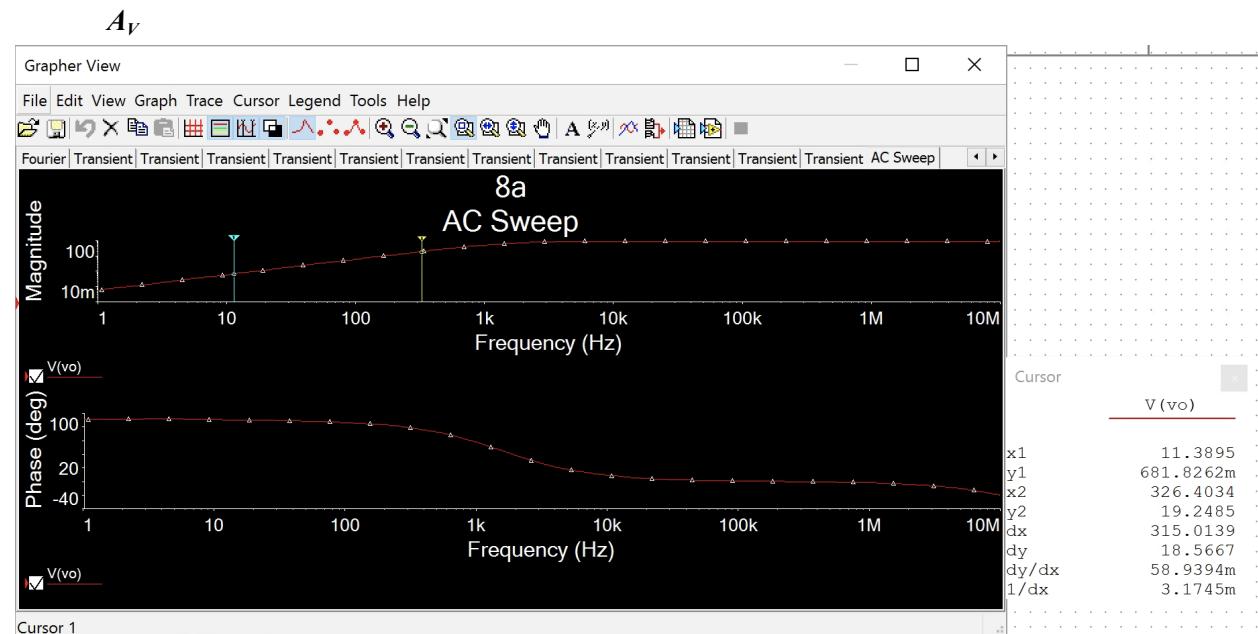
### Fourier Simulation 7a

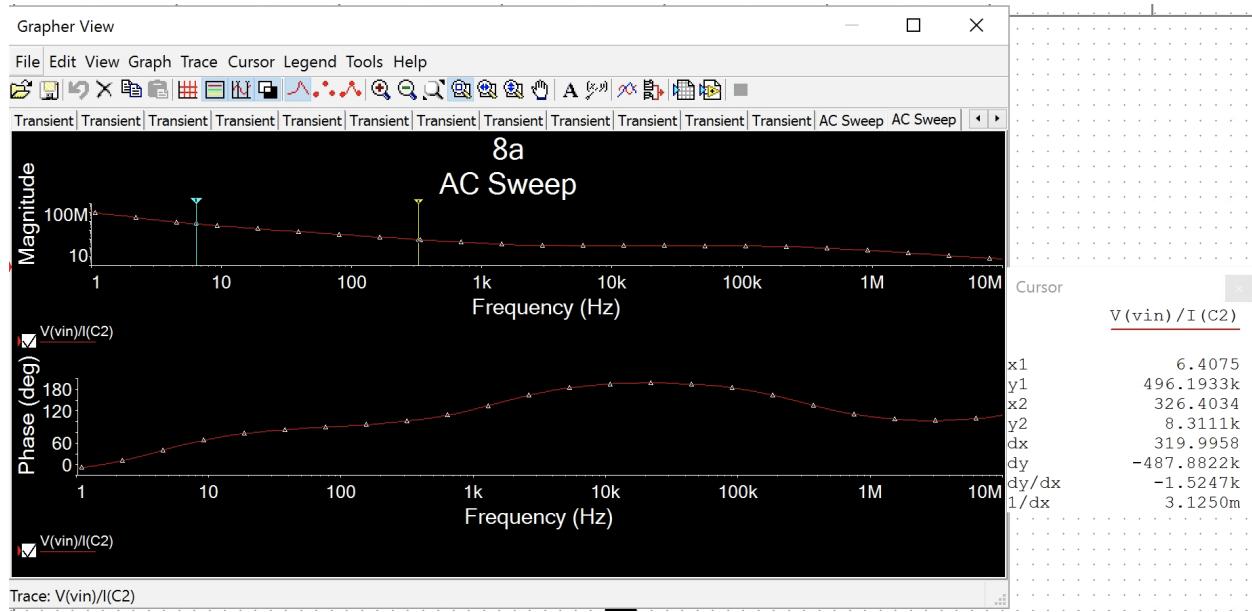
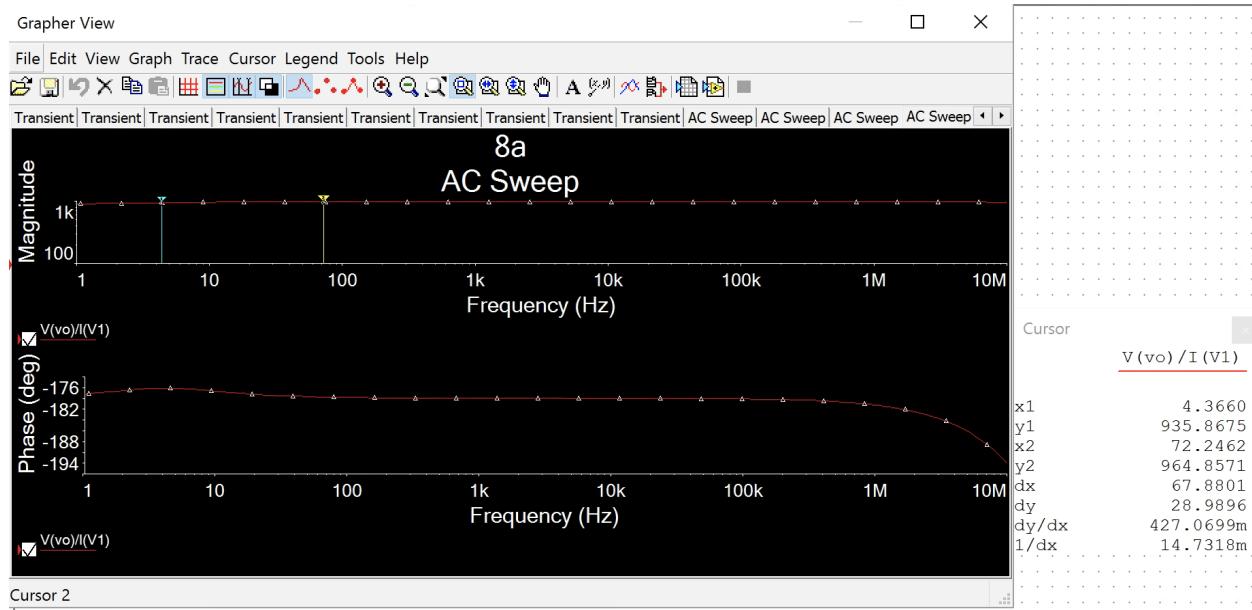


**Figure 8a**  
**Schematic/ DC operating point 8a**

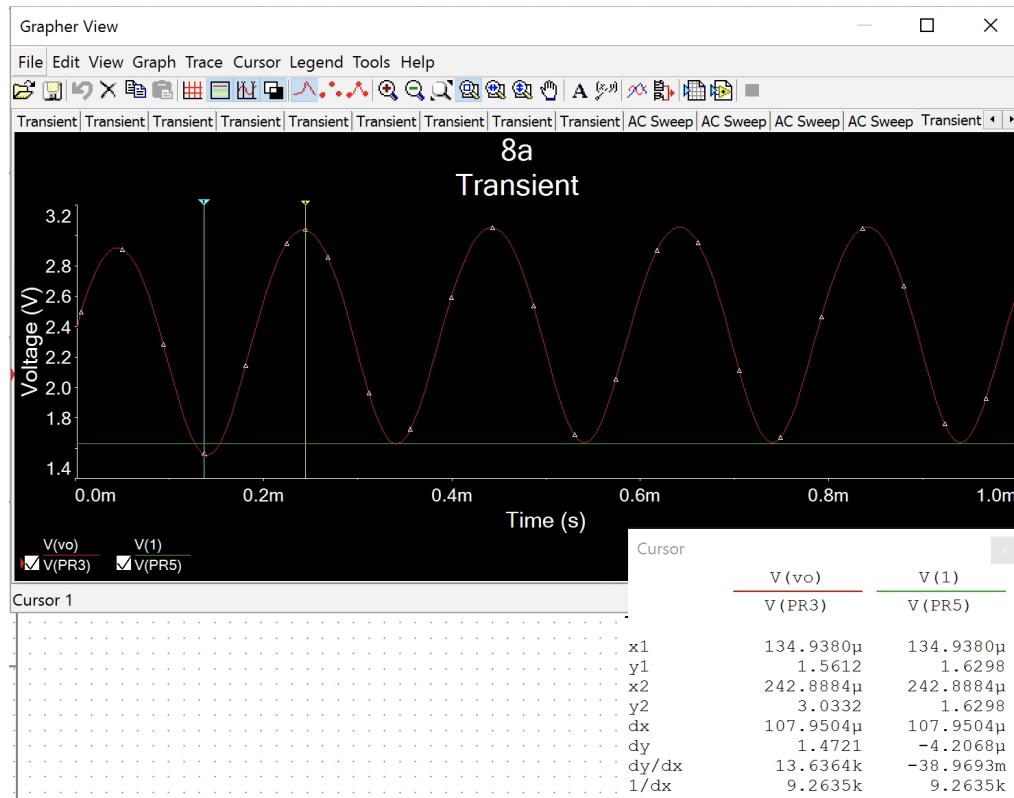


**AC simulation 8a**

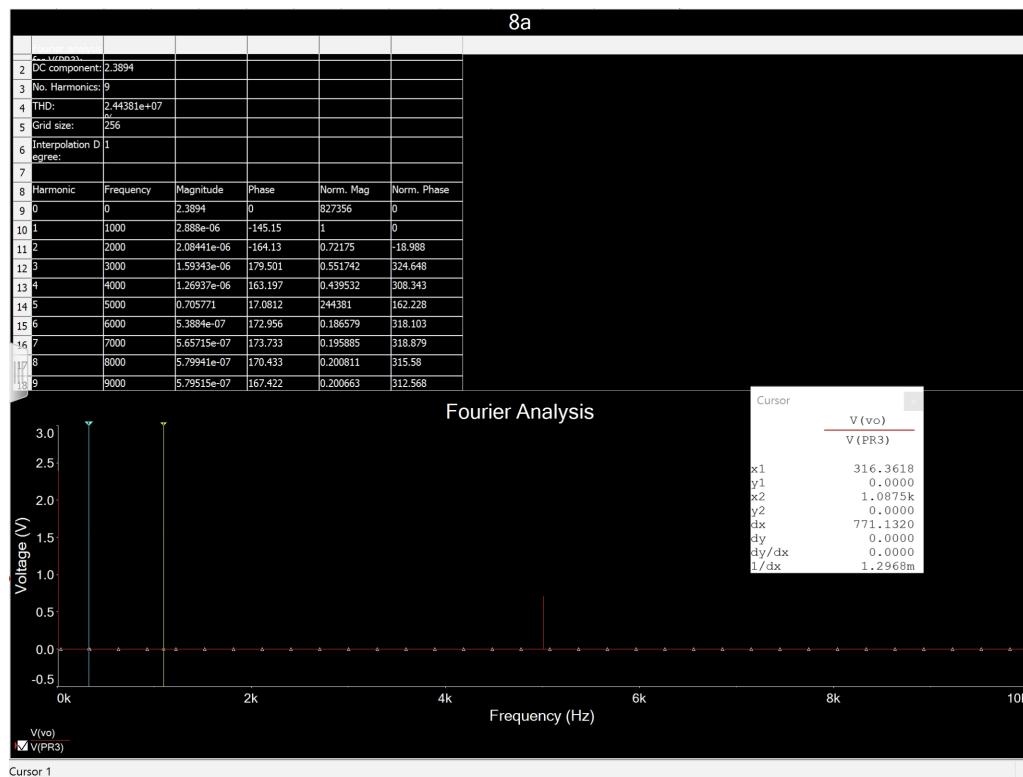


$R_i$  $R_o$ 

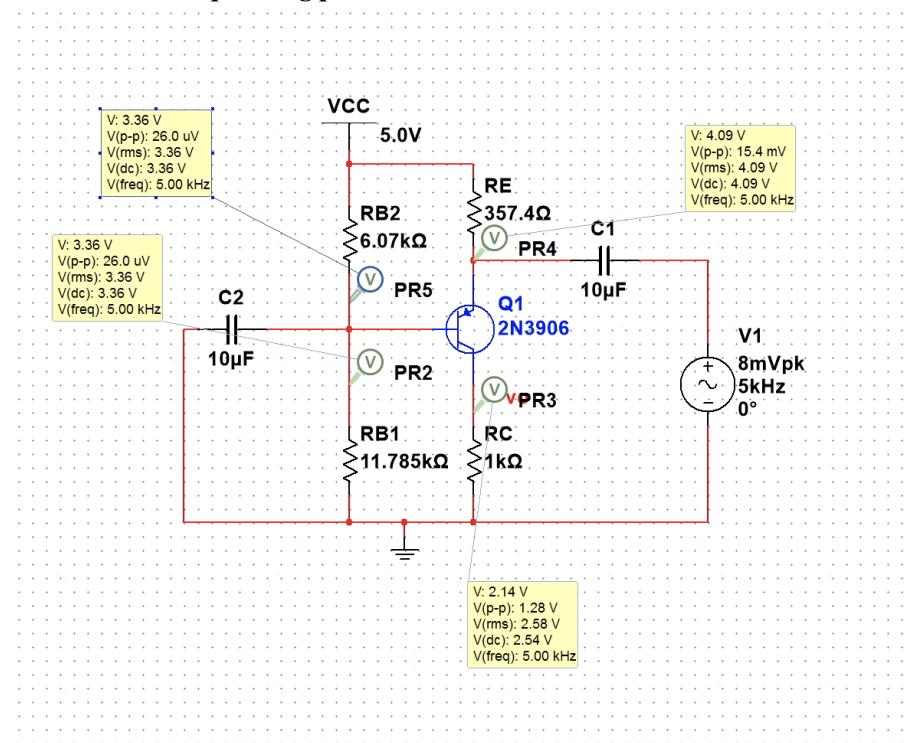
### Transient Simulation 8a



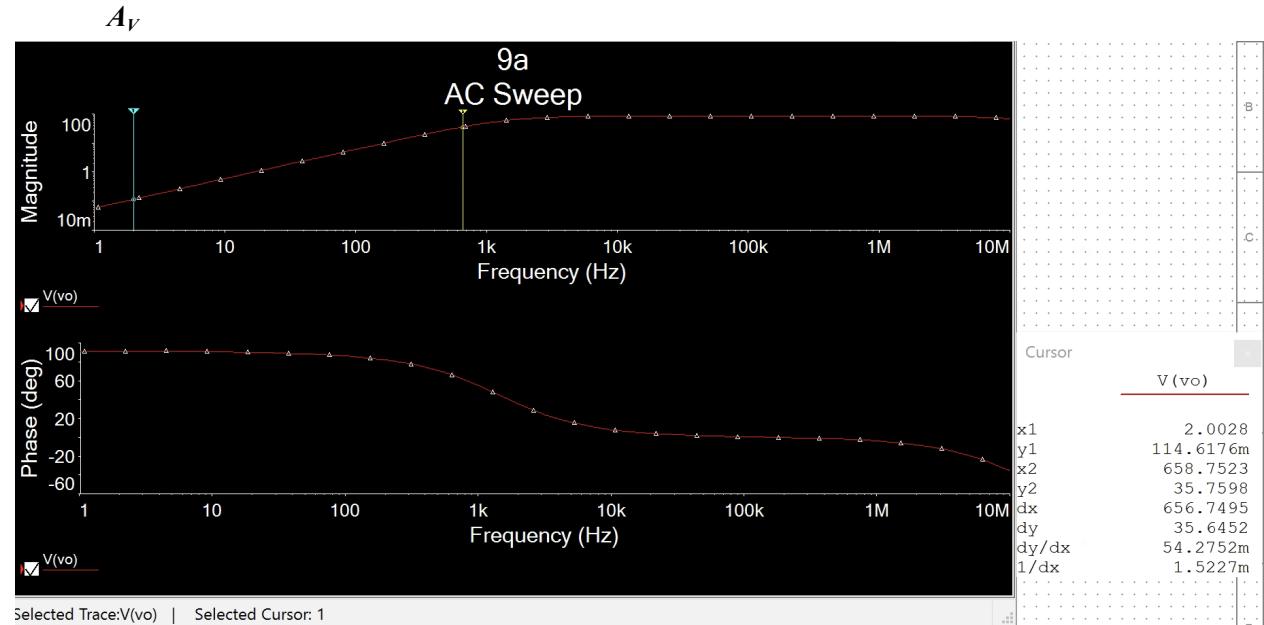
### Fourier Simulation 8a

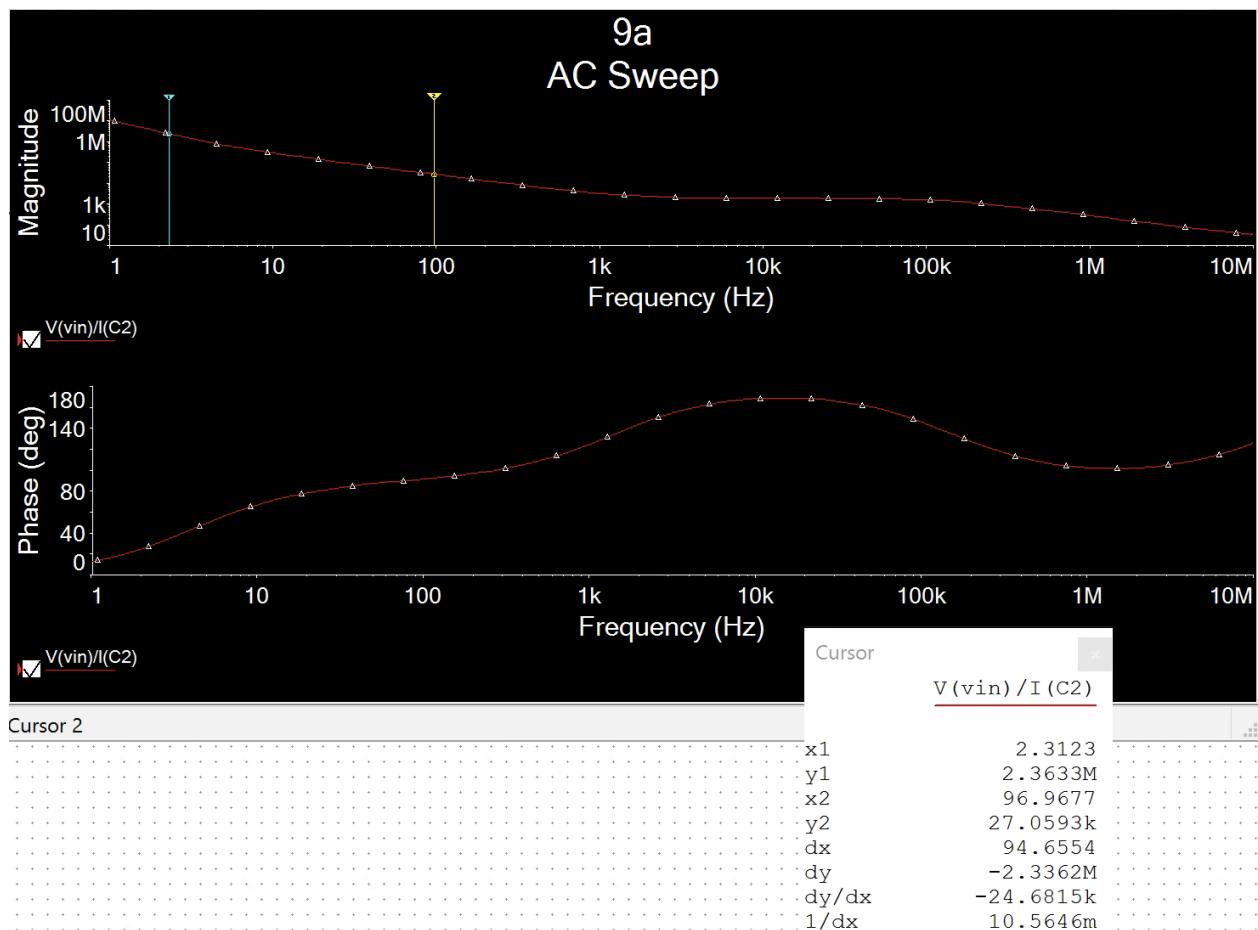
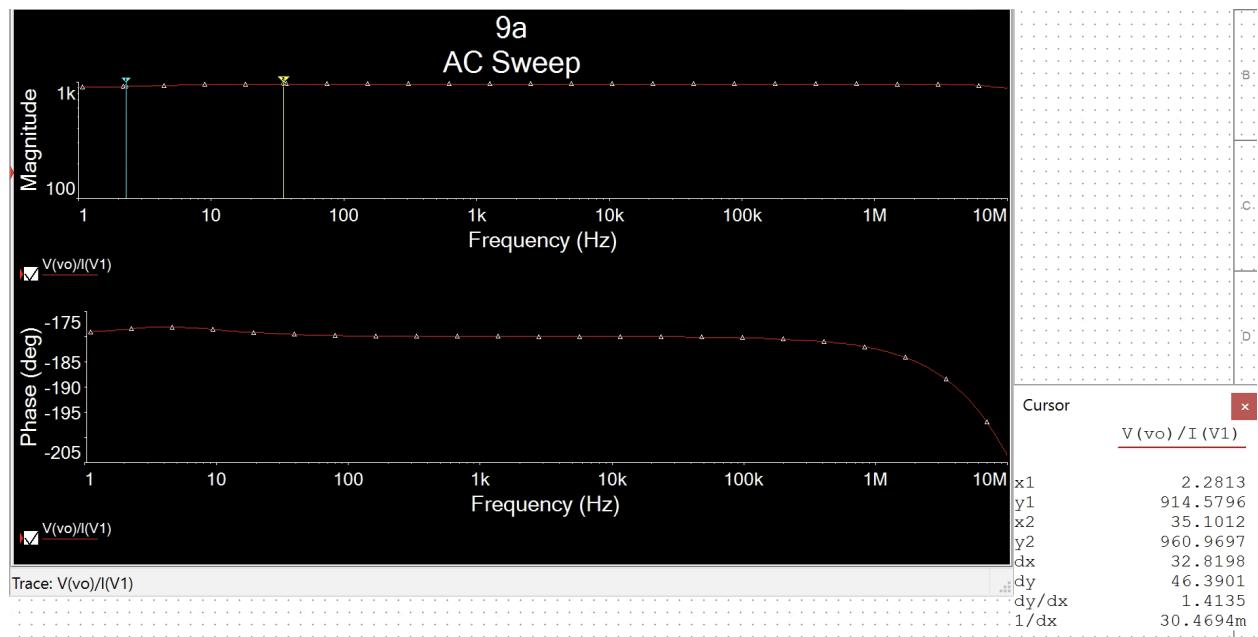


**Figure 9a**  
**Schematic/ DC operating point 9a**

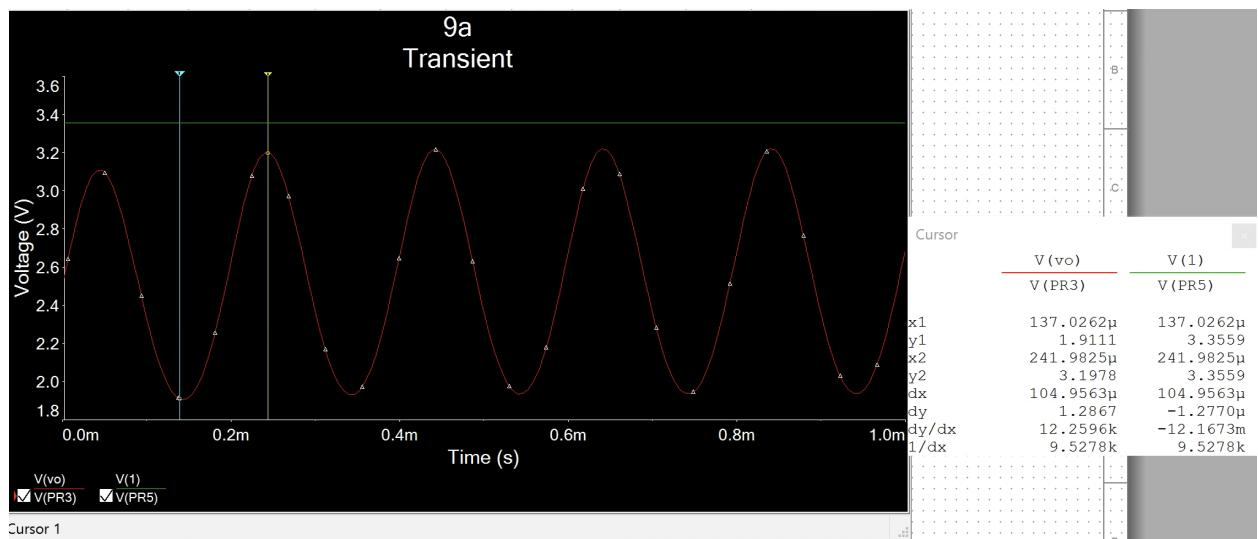


**AC simulation 9a**



$R_i$ 9a  
AC Sweep $R_o$ 9a  
AC Sweep

### Transient Simulation 9a



### Fourier Simulation 9a

