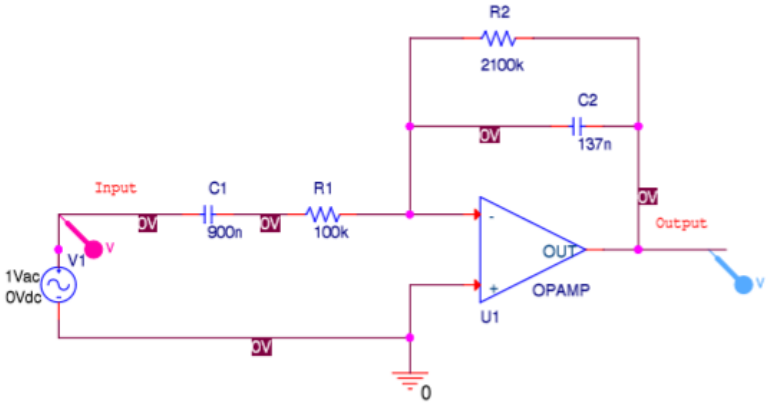
Electronics Design project 2

Laboratory 2: Practical design skills. Using PSpice in design. Kaichun Hu 2173845H

1.Reason for the chosen component



This experiment aims to build a circuit that has a voltage gain of 5 at 1Hz and reject the mains frequency of 50Hz (i.e. have a low gain at 50Hz). And from practical restrictions, all resistance must not get larger than about 3MΩ and the capacitance should not be greater than 1uF.

The following values were chosen to achieve a gain of about 5 at 1Hz and low gain at 50Hz.

C1=900nF R1=100kΩ C2=137nF R2=2100kΩ

The centre frequency is calculated using the following equation which is equal to 1Hz.

$$f = \frac{1}{2\pi \cdot \sqrt{R_1 C_1 R_2 C_2}}$$

$$\frac{1}{2 \cdot \pi \cdot \sqrt{\left(900 \cdot 10^{-9}\right) \cdot 100 \cdot 10^{3} \cdot \left(2100 \cdot 10^{3}\right) \cdot 137 \cdot 10^{-9}}}$$

$$= 0.9890743652$$

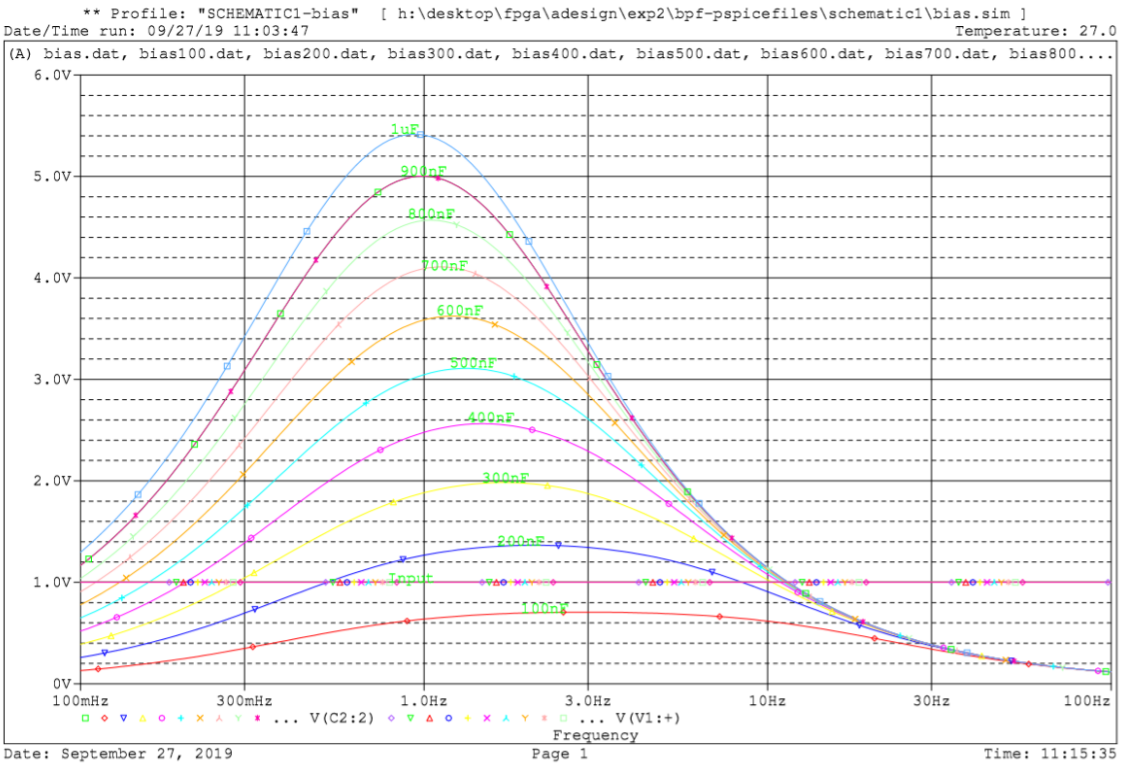
The gain at 1Hz is calculated using the formula below and is equal to 5.

$$Gain = \frac{\sqrt{\frac{{R_2}^2 \cdot \frac{1}{wC_2}^2}{{R_2}^2 + \frac{1}{wC_2}^2}}}{\sqrt{{R_1}^2 + \frac{1}{wC_1}^2}}$$

$$\left(\frac{\sqrt{\frac{\left(2100 \cdot 10^{3}\right)^2 \cdot \left(\frac{1}{\left(2\pi \cdot 1 \cdot 137 \cdot 10^{-9}\right)}\right)^2}{\left(2100 \cdot 10^{3}\right)^2 + \left(\frac{1}{\left(2\pi \cdot 1 \cdot 137 \cdot 10^{-9}\right)}\right)^2}}}{\sqrt{\left(100 \cdot 10^{3}\right)^2 + \left(\frac{1}{\left(2\pi \cdot 1 \cdot 900 \cdot 10^{-9}\right)}\right)^2}} \right)$$

$$= 5.00375218486$$

2. Plot of output voltage against frequency (Including a family of curves showing how the value of C1, the input capacitor, changes the low frequency cut-off of the design.)



3. The same data with the graphs in dB