Skill Experiment-3: VOLTAGE SHUNT FEEDBACK AMPLIFIER

Aim:

To design, construct, and study the performance of a voltage shunt feedback amplifier and observe the effect of negative feedback on amplifier parameters such as gain, input impedance, and output impedance.

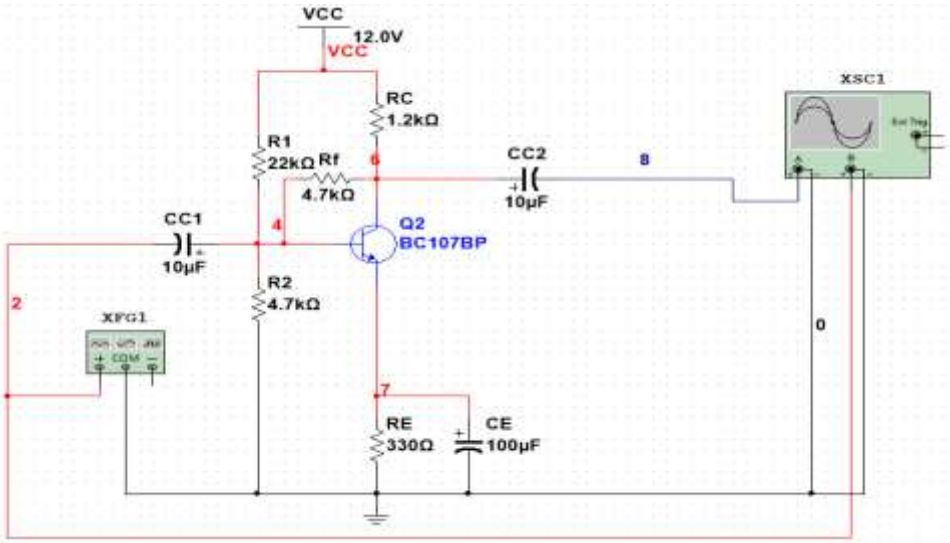
Apparatus Requirement:

S.No	Apparatus/Component	Specification	Quantity
1	Transistor	BC107 or similar	1
2	Resistors	Various (as per design)	As required
3	Capacitors	10 µF, 100 µF, 0.1 µF	As required
4	Function Generator	1Hz–1MHz	1
5	Dual DC Power Supply	0–30V	1
6	CRO or DSO	20 MHz or higher	1
7	Multimeter	Digital or Analog	1

Pre-Lab Questions:

1. What is the purpose of feedback in amplifiers?
2. How does voltage shunt feedback affect the gain of an amplifier?
3. Differentiate between voltage series and voltage shunt feedback.
4. How is input and output impedance affected in a voltage shunt feedback amplifier?
5. Write the general expression for voltage gain with feedback.

Circuit Diagram



Procedure:

1. Connect the components as shown in your circuit image:
    - Base of the transistor is biased using a voltage divider formed by R_1 and R_2.
    - The signal from the function generator is coupled to the base via capacitor C_{C1}.
    - The collector is connected to V_{CC} through R_C and to the oscilloscope through C_{C2}.
    - The emitter is grounded via R_E, and a bypass capacitor C_E is connected in parallel with R_E.
    - The feedback resistor Rf connects from collector to base for voltage shunt feedback.
2. For the input signal, set the function generator:
    - Type: Sine wave
    - Frequency: 1 kHz
    - Amplitude: 20 mV peak-to-peak (10 mV amplitude)
    - DC Offset: 0V
3. Probe points:
    - Channel A of the oscilloscope is connected to input signal (after C_{C1}).
    - Channel B is connected to the output across C_{C2}.
4. Run the simulation:
    - Click the “Run” button (green play icon).
    - Observe the input and output waveforms on the oscilloscope.
    - Note the gain (Vout / Vin) and verify signal phase.
5. To observe frequency response, perform the following:
    - Open the AC Analysis from Simulate > Analyses > AC Analysis.
    - Configure:
        - Start Frequency: 1 Hz
        - Stop Frequency: 1 GHz
        - Number of points per decade: 10
        - Output Variable: Select voltage at node 8 (output) and node 2 (input)
        - Plot: Gain in dB (20*log(Vout/Vin))
    - Run the simulation and observe the Bode plot (magnitude vs frequency).
    - Identify mid-band gain, lower and upper cutoff frequencies, and bandwidth.
6. To compare with and without feedback:

- First, simulate with feedback (Rf connected from collector to base as in the current circuit).
- Save the results (note gain and bandwidth).
- Next, remove the feedback resistor Rf from the circuit (delete or disconnect it).
- Rerun the simulation and perform AC analysis again using same settings.
- Compare gain and bandwidth from the two Bode plots.

7. Analysis:

- With feedback:
  - Gain is lower.
  - Bandwidth is higher.
  - Improved linearity and reduced distortion.
- Without feedback:
  - Gain is higher.
  - Bandwidth is lower.
  - More distortion possible.

Expected graphs:

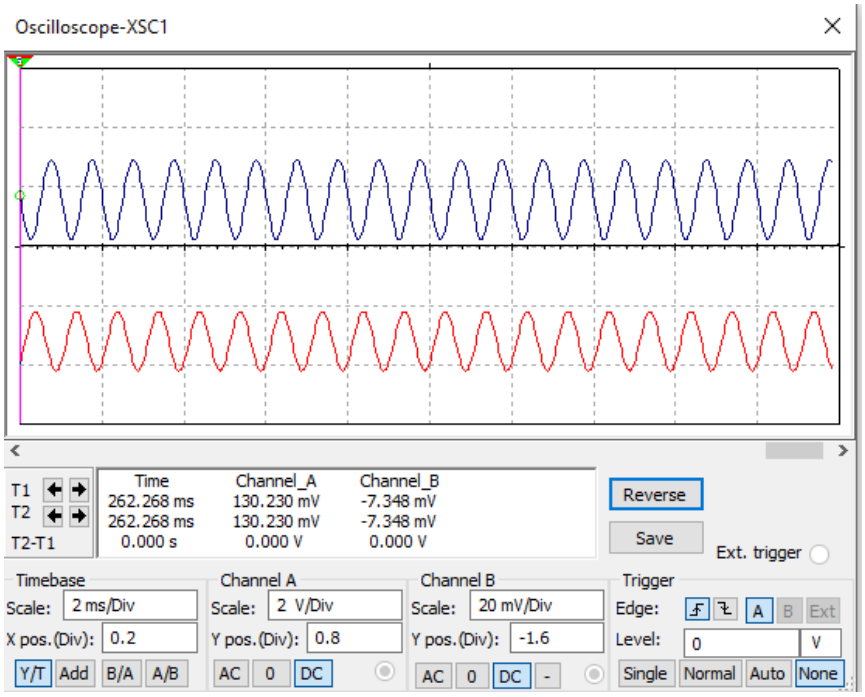


Fig: input and output waveforms observed in oscilloscope

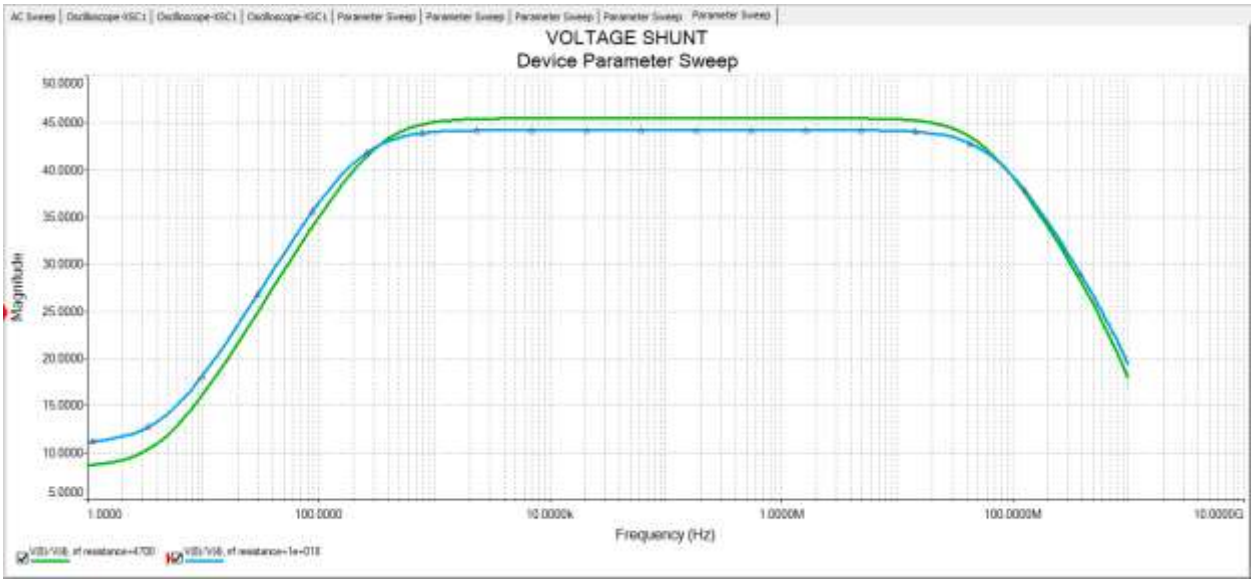


Fig: Comparison of frequency response of voltage shunt feedback amplifier with and with out feedback.

Post Lab Tasks:

1. Tabulate experimental readings: Input voltage, output voltage, gain, input and output impedance.
2. Plot graphs (if required): Gain vs frequency, gain with/without feedback.
3. Answer analysis questions: Effect of feedback on stability, bandwidth, gain.
4. Compare theoretical, Simulated and practical values.
5. Submit lab report with neat circuit diagram and result discussion.

Viva Questions:

1. What is the principle of voltage shunt feedback?
2. How does feedback improve amplifier performance?
3. What happens to the gain when negative feedback is applied?
4. How does voltage shunt feedback affect bandwidth?
5. What is the effect of negative feedback on distortion?

Evaluator Remark (if Any):	**Marks Secured: _____out of 50**
	Signature of the Evaluator with Date