Lab 08 Report
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EE 316

Amplification of a Signal at Low/High Frequencies using BJTs

In this lab we look at the effect of frequency on an amplifier circuit built around a BJT. We know from the theoretical analysis at the beginning of the lab that our circuit has a filtering aspect to it which should dampen low frequencies and allow higher frequencies to be amplified. We believe this is cause by the capacitors in place in our circuit, which saturate at lower frequencies and halt the circuit's current flow. At higher frequencies the capacitors spend more time unsaturated and act more as shorts rather than open circuits.
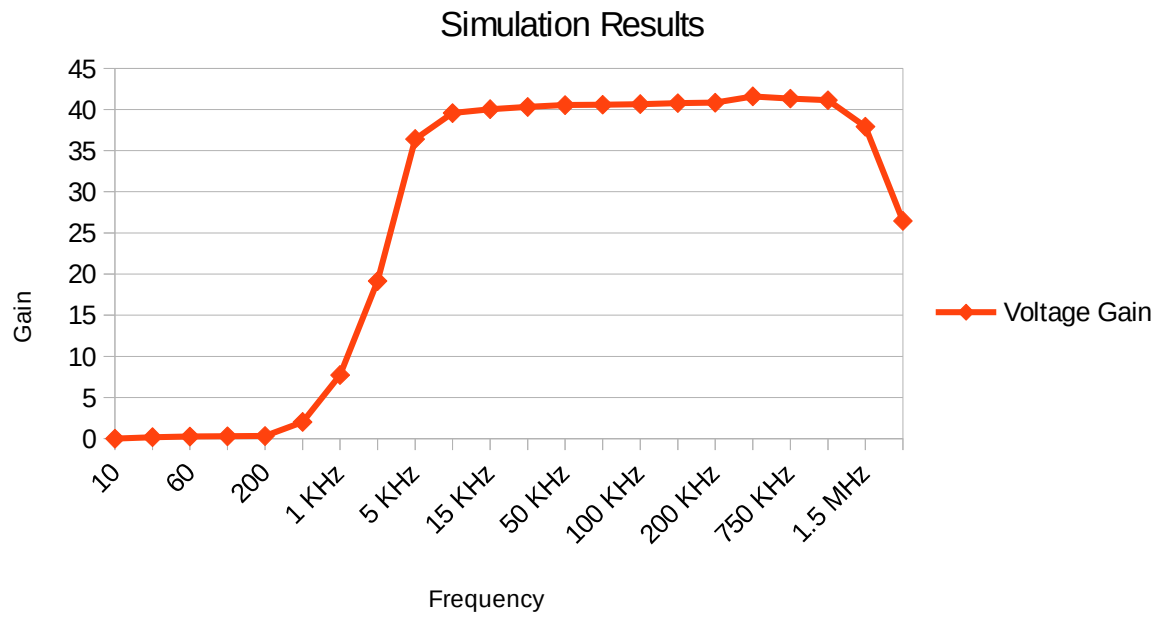
Simulation

The simulated circuit has an input voltage of 0.1V, and is modeled after the following:
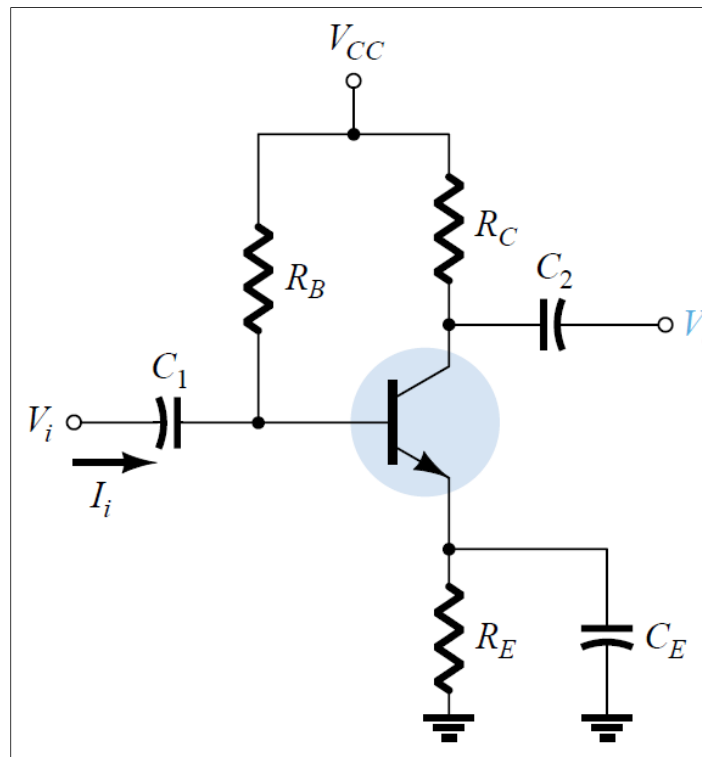
Simulation Results

Frequency	Vout (V)	Voltage Gain
10	0.000	0
30	0.019	0.19
60	0.026	0.26
100	0.030	0.3
200	0.033	0.33
500	0.203	2.03
1 KHz	0.773	7.73
2 kHz	1.915	19.15
5 KHz	3.641	36.41
10 KHz	3.956	39.56
15 KHz	4.004	40.04
20 KHz	4.030	40.3
50 KHz	4.053	40.53
75 KHz	4.058	40.58
100 KHz	4.065	40.65
150 KHz	4.077	40.77
200 KHz	4.083	40.83
500 KHz	4.160	41.6
750 KHz	4.132	41.32
1 MHz	4.113	41.13
1.5 MHz	3.792	37.92
2.0 MHz	2.646	26.46

Simulation Results

Voltage Gain plotted as Gain versus Frequency. X-axis labels: 10, 60, 200, 1 KHz, 5 KHz, 15 KHz, 50 KHz, 100 KHz, 200 KHz, 750 KHz, 1.5 MHz. Y-axis (Gain): 0 to 45.

Hardware Results

Hardware circuit was analyzed with a 1V input.

Frequency	Vout (V)	Voltage Gain
10	0.000	0
30	0.164	1.64
60	0.458	4.58
100	0.879	8.79
200	2.046	20.46
500	3.982	39.82
1 KHz	4.360	43.6
2 kHz	4.231	42.31
5 KHz	4.229	42.29
10 KHz	6.029	60.29
15 KHz	5.599	55.99
20 KHz	5.890	58.9
50 KHz	6.042	60.42
75 KHz	7.252	72.52
100 KHz	6.040	60.4
150 KHz	5.734	57.34
200 KHz	5.452	54.52
500 KHz	5.281	52.81
750 KHz	4.849	48.49
1 MHz	4.853	48.53
1.5 MHz	4.937	49.37
2.0 MHz	5.091	50.91

Hardware Results
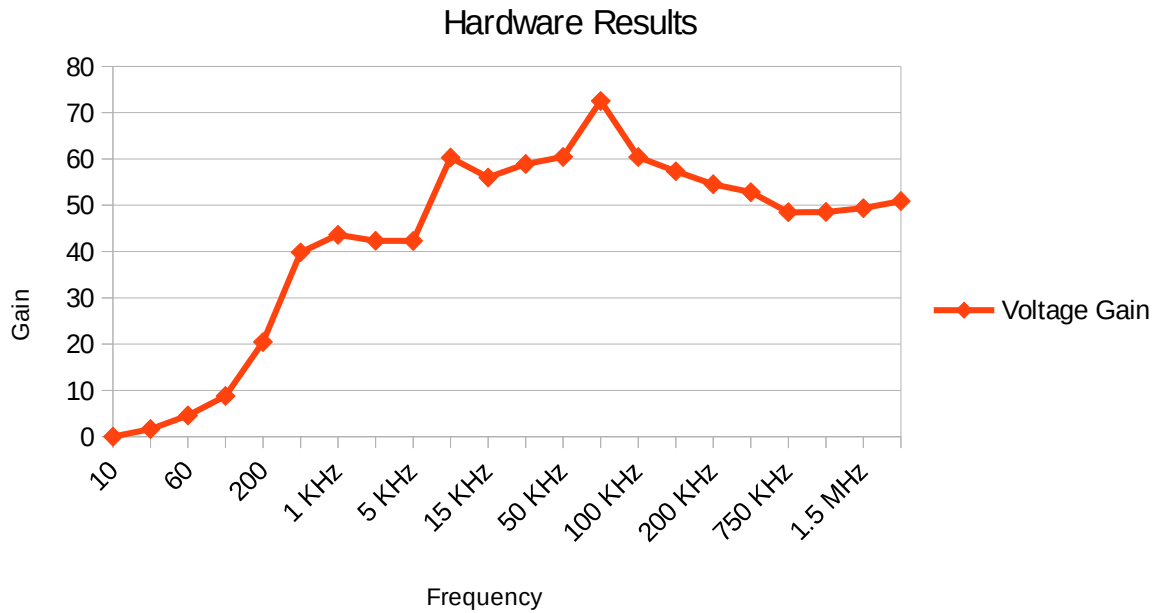
As we can see from the gathered data, the BJT circuits do match our hypothesis of amplification. After some fairly low frequencies are damped, all others are amplified by the circuit, and a graph of their gain holds some similarities to Op-Amp outputs. We can suppose from this information that a lower capacitance value would lead to more low end frequencies being damped, and a higher capacitance would allow more amplification in lower frequencies.