ELEX 3120/3321: Electric Circuits 2

LAB 6 – Non Ideal

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1 Introduction

Operational amplifiers (op-amps) are essential components in electronic circuits, widely used for signal amplification and processing. However, their performance is influenced by non-ideal characteristics such as slew rate, input offset voltage, input bias current, and variations in open-loop and closed-loop gain. This lab explores these non-ideal properties using the LM741 and TL084 op-amps. By comparing measured parameters with datasheet specifications, this experiment aims to deepen understanding of op-amp limitations and their impact on circuit behavior.

2 Experiments

2.1 Op-Amp Parameters

	Slew Rate	Input Offset Voltage	Input Bias Current	A_{OL}
Units	*V/µs*	mV	pA	V/mV
Typical	13	3	30	200
Maximum	-	6	200	-

Table 1 - TL084 Parameters

	Slew Rate	Input Offset Voltage	Input Bias Current	A_{OL}
Units	*V/µs*	mV	pA	V/mV
Typical	0.5	1	80	200
Maximum	-	5	500	-
Measured	0.65	1.8	95	198

Table 2 – LM741 Parameters

2.2 Slew Rate

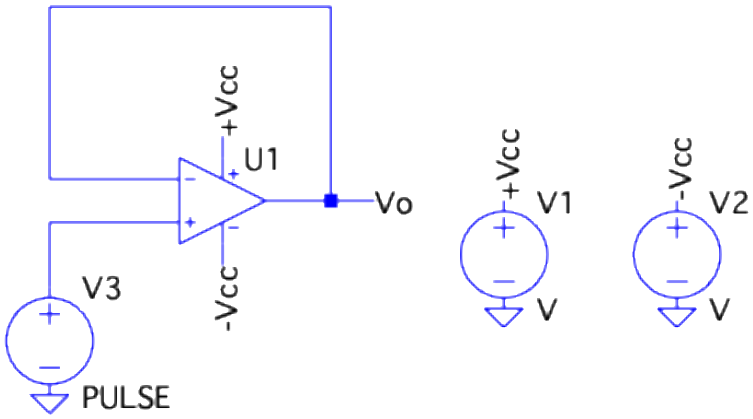

Figure 1 - Slew Rate Schematic

$SR = \frac{\Delta V_{out}}{\Delta t}$

2.3 Input Offset Voltage

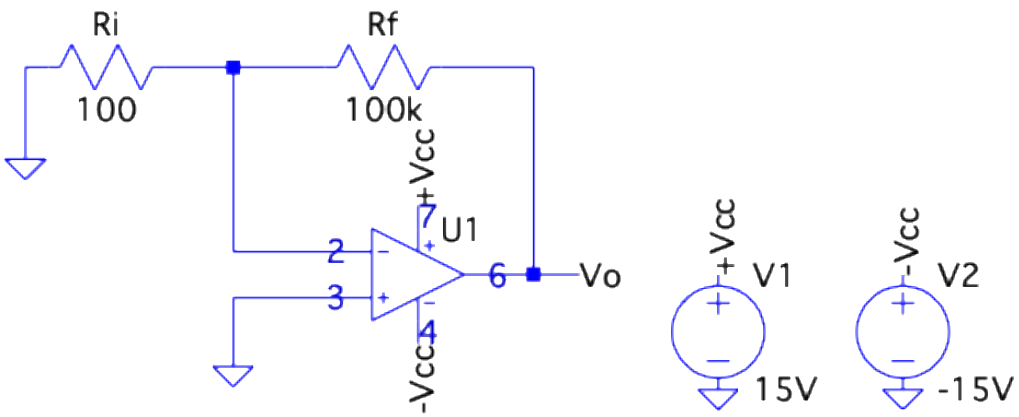

Figure 2 - Input Offset Voltage Schematic

2.4 Input Bias Current

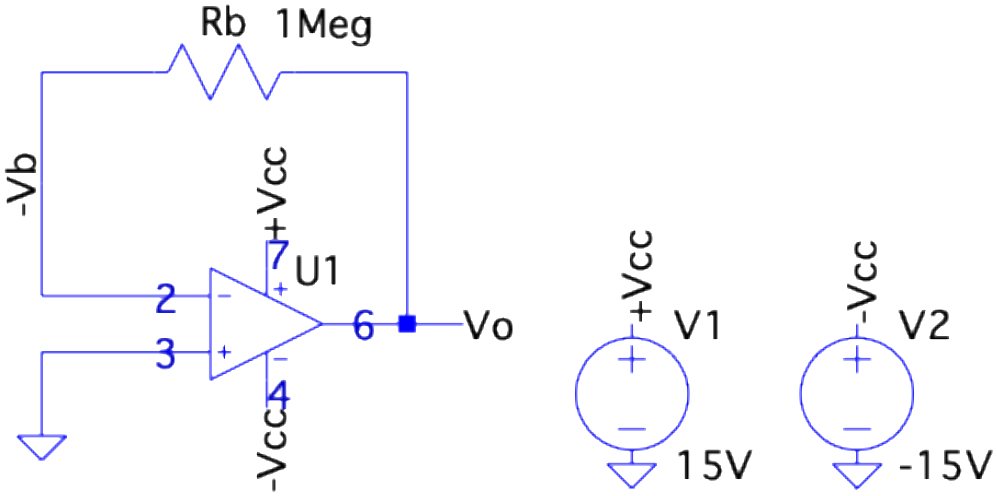

Figure 3 - Input Bias Current Schematic

2.5 Open and Close Loop Gain

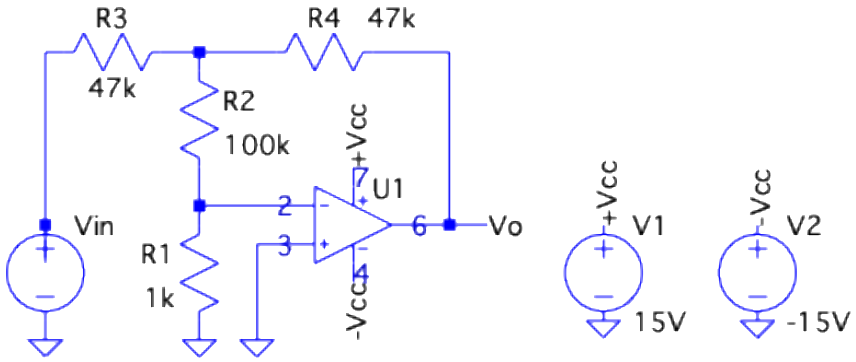

Figure 4 - Open Loop Gain Schematic

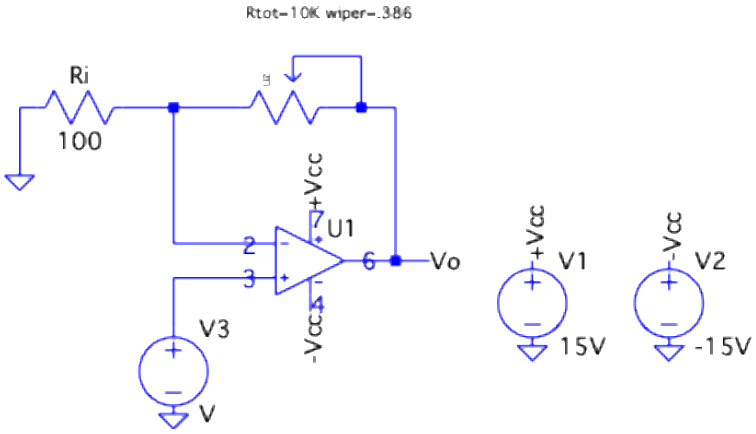

Figure 5 - Close Loop Gain Schematic

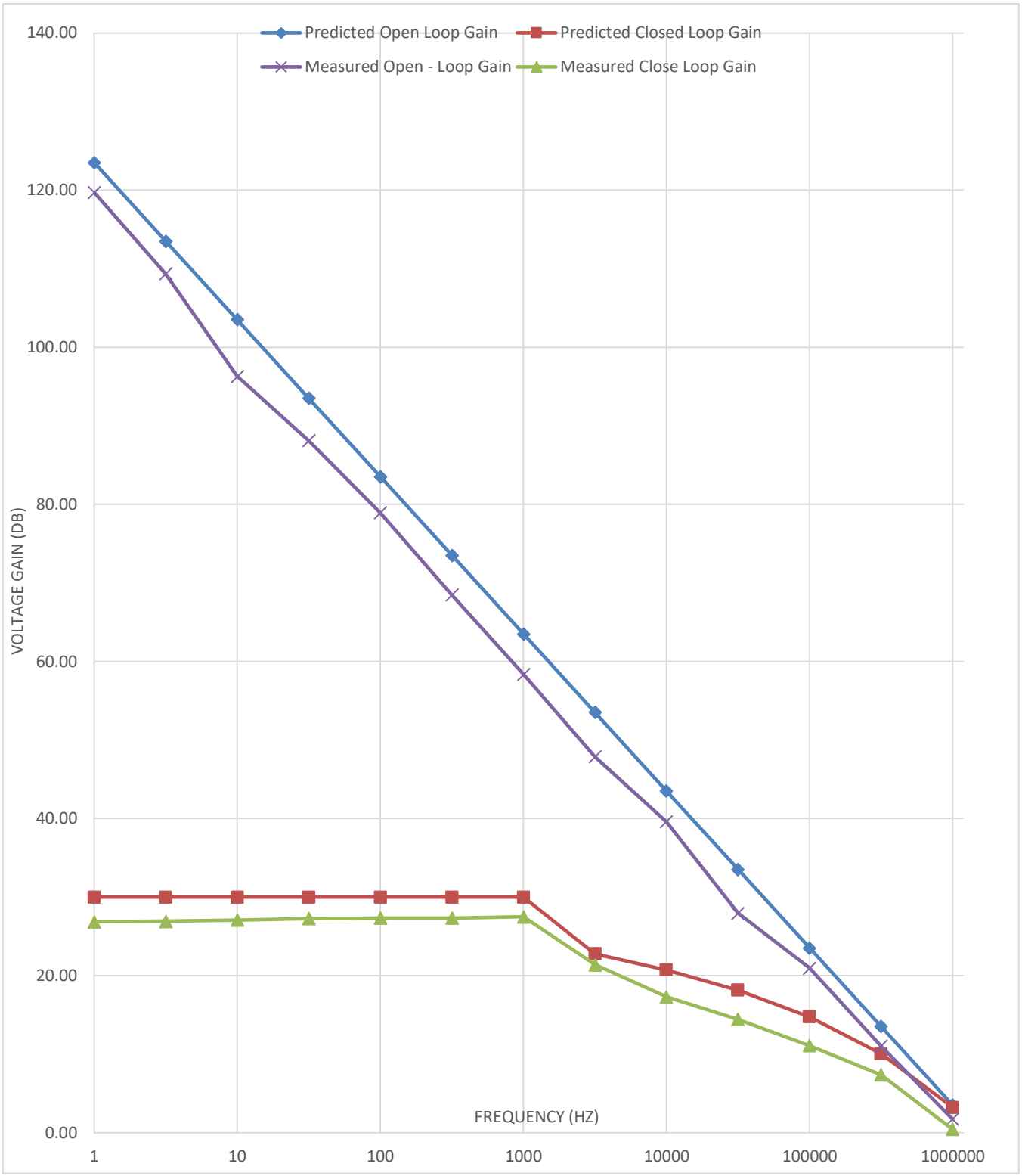

Figure 6 - Predicted and Measured Voltage Gain

Frequency (Hz)	Predicted Open-Loop Gain (AOL)	Predicted Closed-Loop Gain (ACL)	Measured Open-Loop Gain (AOL)	Measured Closed-Loop Gain (ACL)
1	123.52	30.00	119.72	26.87
3.16227766	113.52	30.00	109.36	26.91
10	103.52	30.00	96.32	27.07
31.6227766	93.52	30.00	88.12	27.27
100	83.52	30.00	78.94	27.33
316.227766	73.52	30.00	68.47	27.34
1000	63.52	30.00	58.38	27.5
3162.27766	53.52	22.77	47.88	21.39
10000	43.52	20.74	39.59	17.28
31622.7766	33.52	18.16	27.94	14.44
100000	23.52	14.76	20.96	11.1
316227.766	13.52	10.08	11.05	7.37
1000000	3.52	3.23	1.72	0.43
		UGBW	1500000	
		Gnf	39.62342211	

Table 3 - Frequency Response Table from Excel

3 Conclusions

This lab successfully demonstrated the measurement and analysis of non-ideal properties of op-amps. The results revealed deviations in slew rate, input offset voltage, input bias current, and gain from ideal values, emphasizing the practical limitations of real-world components. Comparing measured data with datasheet values and pre-lab predictions reinforced the importance of considering these non-idealities in circuit design.