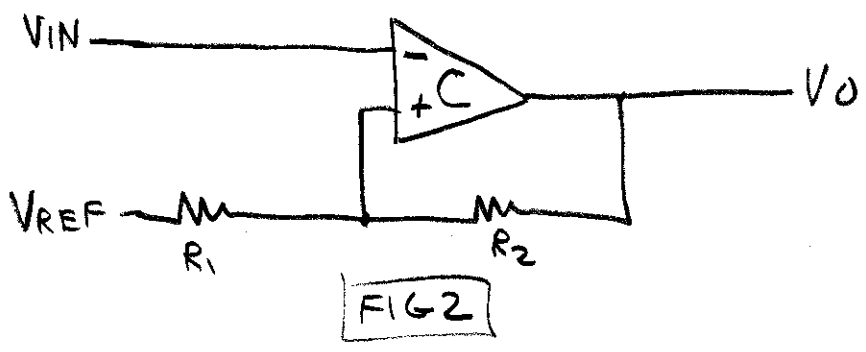
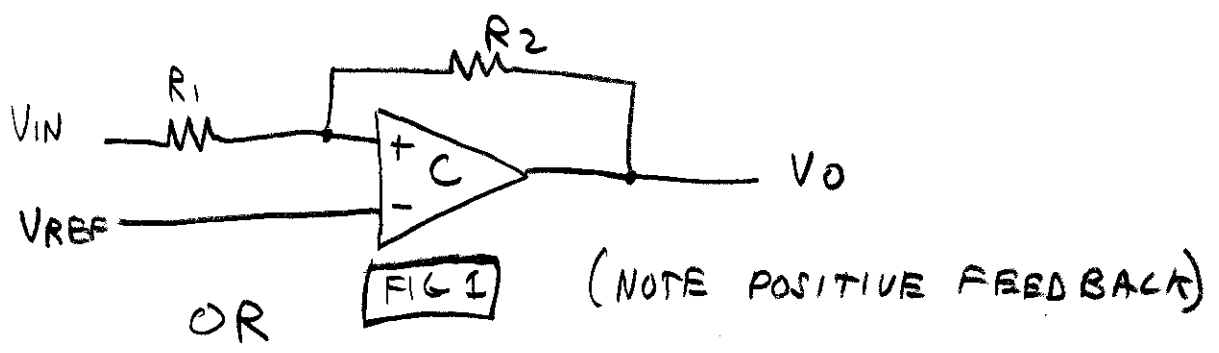
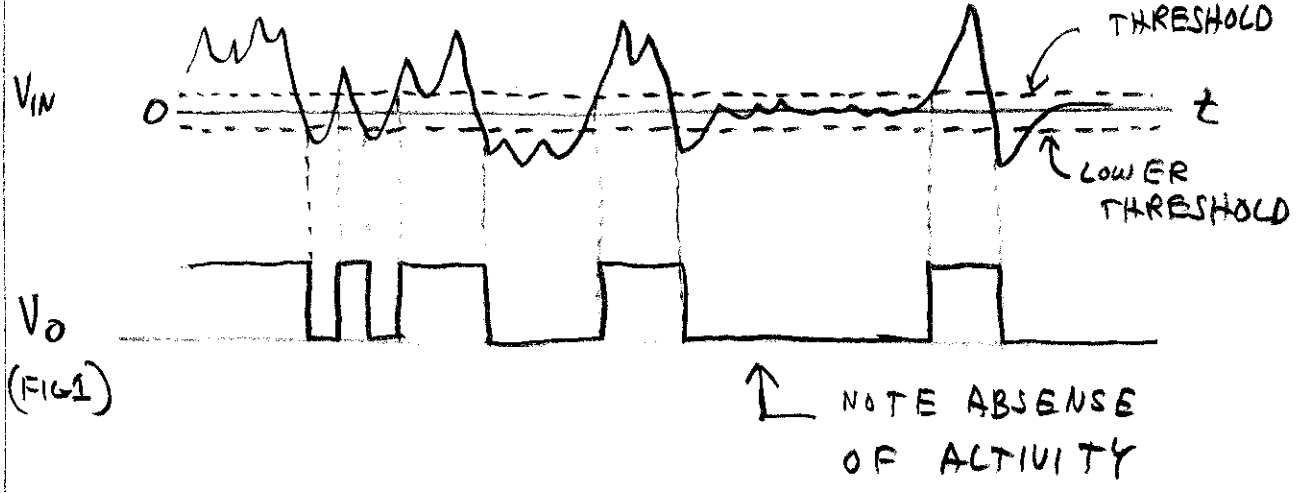


SCHMITT TRIGGER

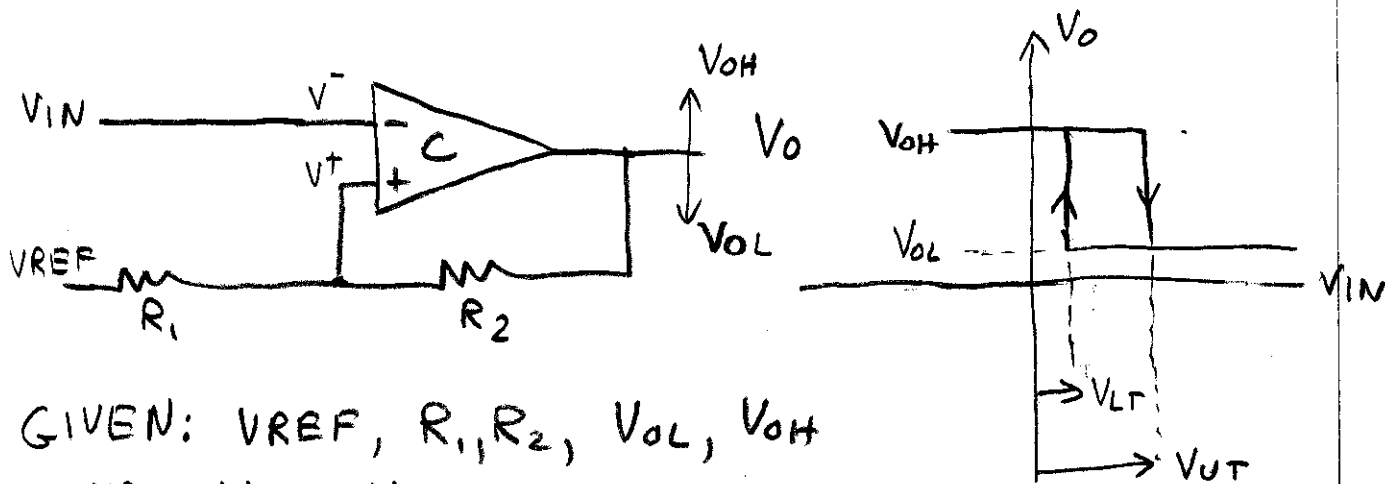


A SCHMITT TRIGGER IS A COMPARATOR WITH POSITIVE FEED BACK TO CREATE A HYSTERISIS ZONE. WHEN THE INPUT RISES ABOVE AN UPPER THRESHOLD, THE OUTPUT CHANGES STATES. THE OUTPUT WILL NOT CHANGE STATES AGAIN UNTIL THE INPUT FALLS BELOW A LOWER THRESHOLD. LOOK AT EXAMPLE FOR COMPARATOR



(FIG 1)

DEVELOP ANALYTIC EQUATIONS FOR FIG. 2. 2/2



GIVEN: V_{REF} , R_1 , R_2 , V_{OL} , V_{OH}

FIND: V_{UT} , V_{LT}

└── LOWER THRESHOLD
└── UPPER THRESHOLD

V_{UT} IS FOUND BY LETTING V_{IN} BE ANY VALUE BELOW V_{UT} SO THAT $V_O = V_{OH}$. NEXT, WE SOLVE FOR THE VOLTAGE AT V^+

$$V^+ = \frac{V_{OH} R_1}{R_1 + R_2} + \frac{V_{REF} R_2}{R_1 + R_2} = \underline{\underline{V_{UT}}}$$

NOW IF V_{IN} RISES ABOVE V_{UT} THEN V_O SWITCHES TO V_{OL} AND THE VOLTAGE AT V^+ DROPS TO THE LOWER THRESHOLD, V_{LT} . SOLVING FOR V_{LT}

$$V_{LT} = \frac{V_{OL} R_1}{R_1 + R_2} + \frac{V_{REF} R_2}{R_1 + R_2}$$

* STUDENT SHOULD DEVELOP DESIGN EQNS.

GIVEN: V_{OH} , V_{OL} , V_{UT} , V_{LT}

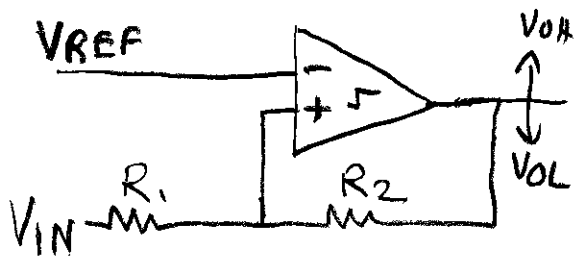
FIND: V_{REF} , R_1 , R_2 (V_{REF} CAN BE + OR -)

WARNING: - NOT A SIMPLE TASK. - ALSO, SOME COMBINATIONS OF GIVEN'S WILL PRODUCE NEGATIVE R'S.

SCHMITT TRIGGER HOMEWORK

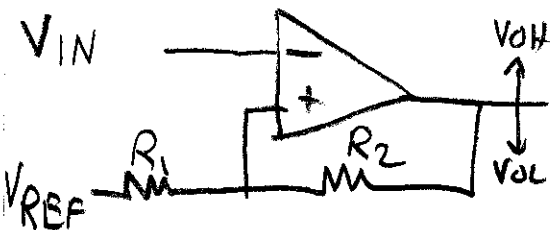
1/2

ANALYSIS



FIND UPPER AND LOWER THRESHOLDS FOR

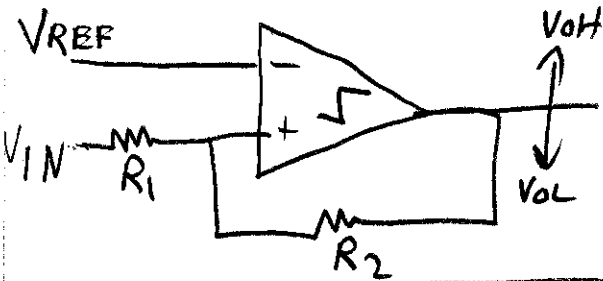
R1	R2	VREF	VOH	VOL	ANSWERS	
					VUT	VLT
4300	10,000	2.0	4.5	0.3	2.7	0.93
10000	100,000	2.5	4.5	0.3	2.7	2.3
10000	15,000	2.5	4.5	0.3	4.0	1.2



FIND UPPER AND LOWER THRESHOLDS FOR

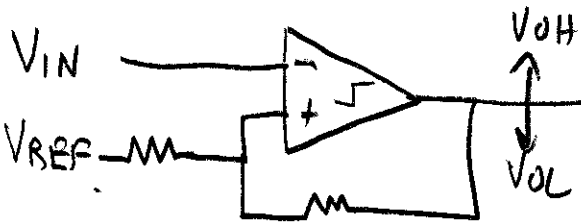
R1	R2	VREF	VOH	VOL	ANSWERS	
					VUT	VLT
2700	10,000	2.5	5	0.1	3	2
10000	30000	1.0	5	0.1	2	0.83
8200	27000	3.0	5	0.1	3.5	2.4

DESIGN



FIND V_{REF} AND R_1/R_2 FOR

V_{UT}	V_{LT}	V_{OH}	V_{OL}	ANSWERS	
				V_{REF}	R_1/R_2
2.2	0.9	4.7	0.1	1.737	0.283
3.0	1.0	4.7	0.1	2.121	0.435
3.67	1.33	4.7	0.1	2.466	0.509



FIND V_{REF} AND R_1/R_2 FOR

V_{UT}	V_{LT}	V_{OH}	V_{OL}	ANSWERS	
				V_{REF}	R_1/R_2
2.2	0.9	4.7	0.1	1.215	0.394
3.0	1.0	4.7	0.1	1.692	0.769
3.67	1.33	4.7	0.1	2.604	1.035