Kathmandu University
Department of Electrical and Electronics Engineering
ELECTRONICS AND ANALOG FILTER DESIGN LAB

EXPERIMENT 5: Positive Feedback with Regeneration and its Application

Objective: To understand the effect of regenerative positive feedback and apply that concept in the design of bistable multivibrator and astable multivibrator

Materials and Equipment:
Resistors: 10KΩ [Pot], 10KΩ [2], 22KΩ [1] Capacitors: 47nF [1] IC 741: [1]

Theory:
If the feedback is positive and if $A_0\beta >> 1$ then it will results in the positive feedback with regeneration. In effect, the output amplitude grows boundlessly hitting the power supply limitation. Output will quickly saturate to the level $+V_{SAT}$ *OR* $-V_{SAT}$ depending upon the initial disturbance.

In case of bistable multivibrator (Fig 2, 3), state change of the comparator occurs at $+\beta V_{SAT}$ when the input is increasing and at $-\beta V_{SAT}$ when the input is decreasing.

In case of astable multivibrator (Fig 4), state change of the comparator occurs at $+\beta V_{SAT}$ and $-\beta V_{SAT}$ depending upon the capacitor voltage. The frequency of oscillation of the square wave is determined by

$$T = 2RC\ln\left(\frac{1+\beta}{1-\beta}\right)$$, where β is the feedback factor.

Positive Feedback with Regeneration

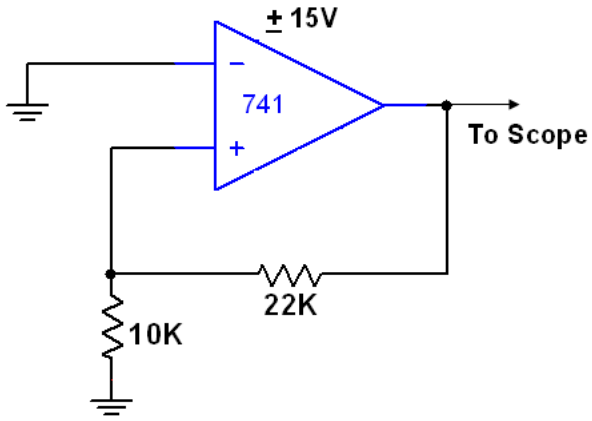

Fig 1

Procedure

1. First remember what your instructor says you in your class. "*I am not sure whether your output is at* $+V_{SAT}$ OR $-V_{SAT}$ *but I am sure that it will be in any one of the state and not in any other state in between".*
2. Monitor the output in the scope.
3. Disconnect the main power supply ground and again connect it.
4. Monitor the output in the scope.
5. Disconnect the main power supply ground and again connect it.
6. Monitor the output in the scope.
7. Disconnect the main power supply ground and again connect it.
8. Monitor the output in the scope.

REALIZE THIS NATURE. SEE THE RANDOM NOISE PHENOMENON.

Bistable Multivibrator (Schmitt Trigger)

Non Inverting Type

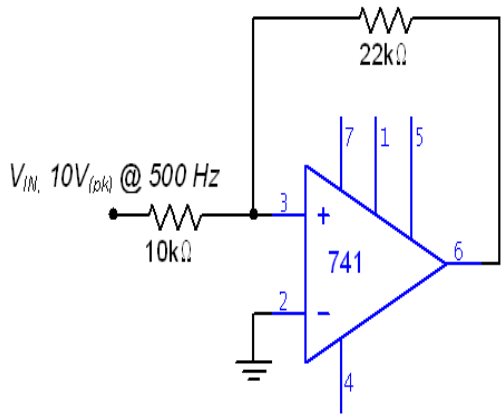

Fig 2 (Same as Fig 1☺)

Procedure

1. Set the input to 10V (pk), sine @ 500Hz
2. Give the input signal (*Reference Signal*) in CH X and output signal in CH Y.
3. See the point in which the Schmitt Trigger changes its state.
4. It should be around ±6.4V.
5. See the output in XY mode and find the width of hysteresis band.
6. Change the X Y position and set the hysteresis band in the centre.
7. Decrease the supply voltage from ± 15 V to ± 10V and see the effect in the hysteresis band.
8. Again increase the supply voltage to ±15V. Decrease the input sine wave amplitude below 6.5V.
9. Where is your hysteresis gone and why?

Inverting Type

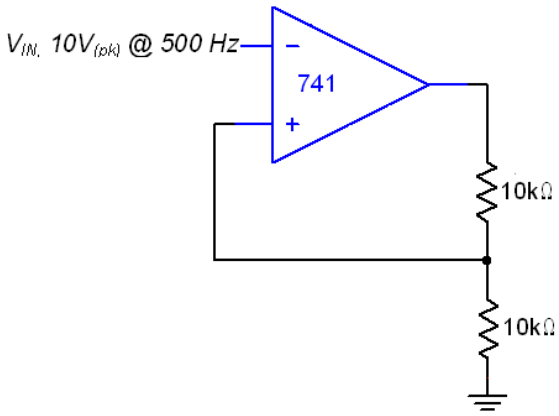

Fig 3

Procedure

1. Find the point at which your Schmitt Trigger changes the state. Use dual mode of Scope.
2. See the Scope in the XY mode.
3. Repeat all the procedures followed in non- inverting type of Schmitt Trigger.
4. Use pot of 10K in place of grounded 10K resistor and change the width of the hysteresis band.

Astable Multivibrator (Square Wave Generator)

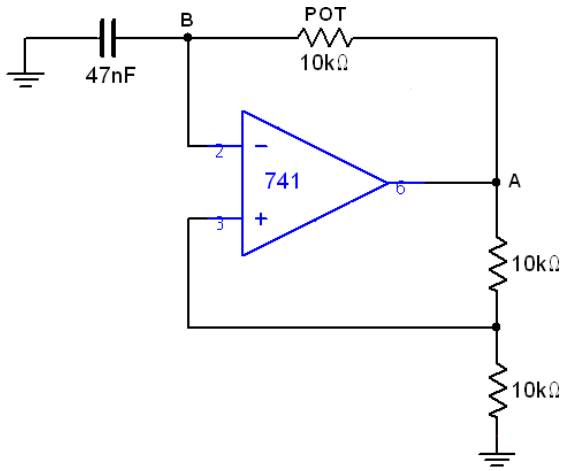

Fig 4

Procedure

1. Connect the circuit as shown.
2. First use 10K resistor in place of Pot.
3. See the output across point A and B in dual mode of oscilloscope.

4. See the capacitor voltage level in which Schmitt Trigger changes its state.
5. Find the frequency of oscillation.
6. Use 10K pot in place of 10K resistor across point A and B and vary it.
7. The output frequency of square wave will vary.