Linearity -- Overview

System Linearity

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OBJECTIVES:

At the end of performing this experiment, learners would be able to:
• Understand the linearity of the given system
• Satisfying the Superposition theorem
•   Test the RC LPF for linearity.

EQUIPMENT:

• Signal generator
• Resistors – 1 kΩ
• Capacitor – 1 µF
• Digital Storage Oscilloscope & probes
• Connecting wires & Bread Board

THEORY:

Two quantities that are directly proportional to each other, such as voltage and current in a simple DC circuit

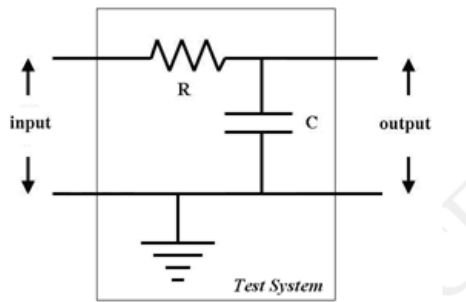# Linearity -- Procedures

Step 1

Circuit setup:
Build the following circuit with given component values

Test System

Step 2

• Choose R = 1 KΩ and C = 1µF   (some typical value)

•Use a signal generator to generate sine wave of 2Vpp(input-I) and square wave of 2Vpp (input- II)
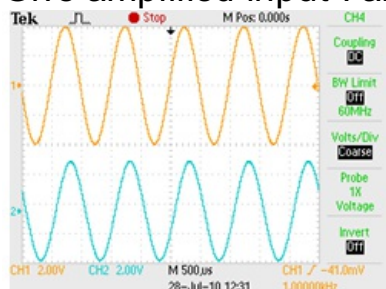
• Observe the corresponding output

Step 3
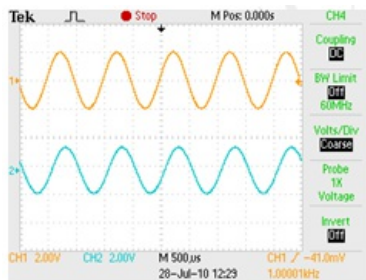
input - I

output - I

Step 4

Give amplified input-I and observe the corresponding output
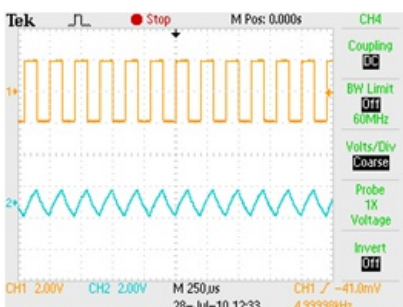

amplified input - I

amplified output - I

Step 5

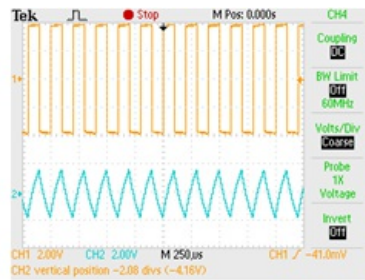Give input-II and observe the corresponding output

input - II

output - II

Step 6

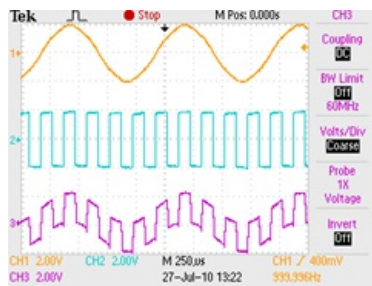Give amplified input-II and observe the corresponding output

amplified input - II

amplified output - II
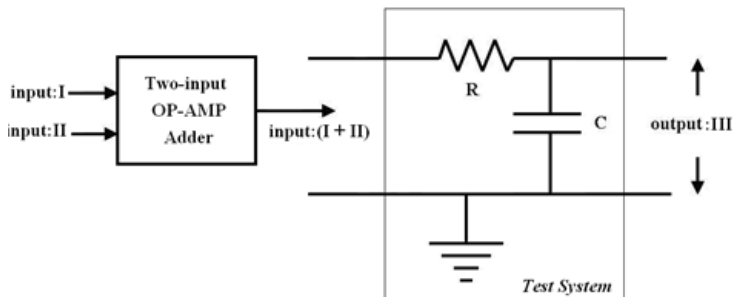
Step 7

Obtain the SUM of the two inputs

input - I

input - II

$(\text{input - I}) + (\text{input - II})$

Step 8

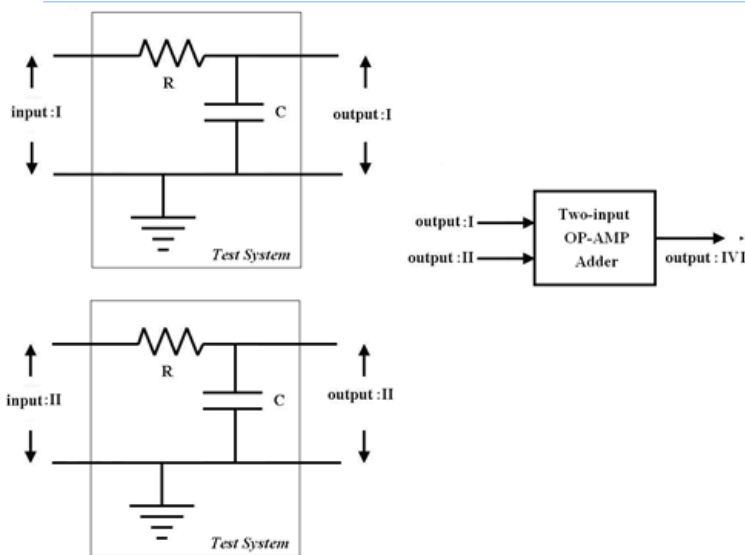Give the SUM of the two inputs and observe the corresponding output

Step 9

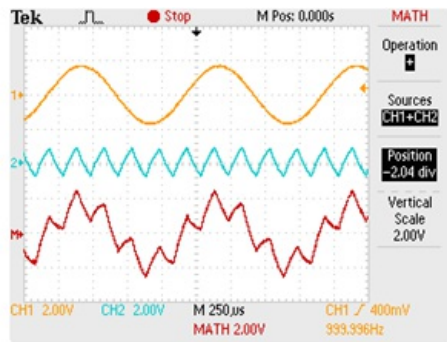$(\text{input : I}) + (\text{input : II})$

corresponding output

Step 10

Connect another similar circuit, and obtain the SUM of the two outputs

Step 11

output : I

output : II

$(output : I) + (output : II)$

Step 12

Observation
1) Results of Steps III and V satisfy Amplitude scaling property
2) Results of Steps VII and VIII prove superposition theorem

Open-ended Question / Can you answer this?
What will be the effect on output waveform if:

1) For a linear time invariant system when the input is sinusoidal, the corresponding output is of same _____ with change in _____ and some _____

2) Different circuit,involving RL or RC or LC or RLC