Experiment 5—Performing Rate and Area Operations

+ **Overall objective: To perform rate & area operations**

  Use 100kΩ pot (variable resistor), 100kΩ resistor, 10 µF capacitor, and 2 op-amps.

  1. With the 3 notches to the right, connect the top terminal of the pot to the +15V and the bottom terminal to ground.
  2. To the right of the pot, build a buffer. Let the pot serve as the buffer's variable input by connecting the pot's middle terminal to the buffer input.
  3. To the right of the buffer, build a derivative circuit and let the buffer's output serve as the derivative circuit's input.

In this experiment, you build a differentiator and an integrator. The circuits each begin with a pot and a buffer that allow you to change the input rapidly or set it to different values.

+ **Observe the output of the derivative circuit**

  Slowly turn the pot and observe the derivative circuit output.
  Now turning the pot faster.
  What do you notice?

The output of the derivative circuit is the rate of change of the input voltage. It should be larger the quicker you turn the pot. It should be equal to zero when the pot is not turning.

Recall that the derivative output is a rate of change of the input voltage. When you turn the pot in one direction, the rate of change is positive and when you turn it in the opposite direction, the rate of change is negative.

+ Observe the output of the integral circuit

4. Turn the pot so that its input to the buffer is 0.5V.
5. Disconnect the supply voltage.
6. Swap the resistor and the capacitor in the derivative circuit. This turns the derivative circuit into an integral circuit.
7. Reconnect the supply voltage and observe the output of the integral circuit. What do you notice?

The output of the integral circuit is the growing area over time of the input voltage. It should saturate at -15V.

Recall that the integral output is the area or accumulation of the input voltage. Even with a constant input voltage, it increases steadily in magnitude over time. The output voltage is positive when the input voltage is negative, and the output voltage is negative when the input voltage is positive.

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