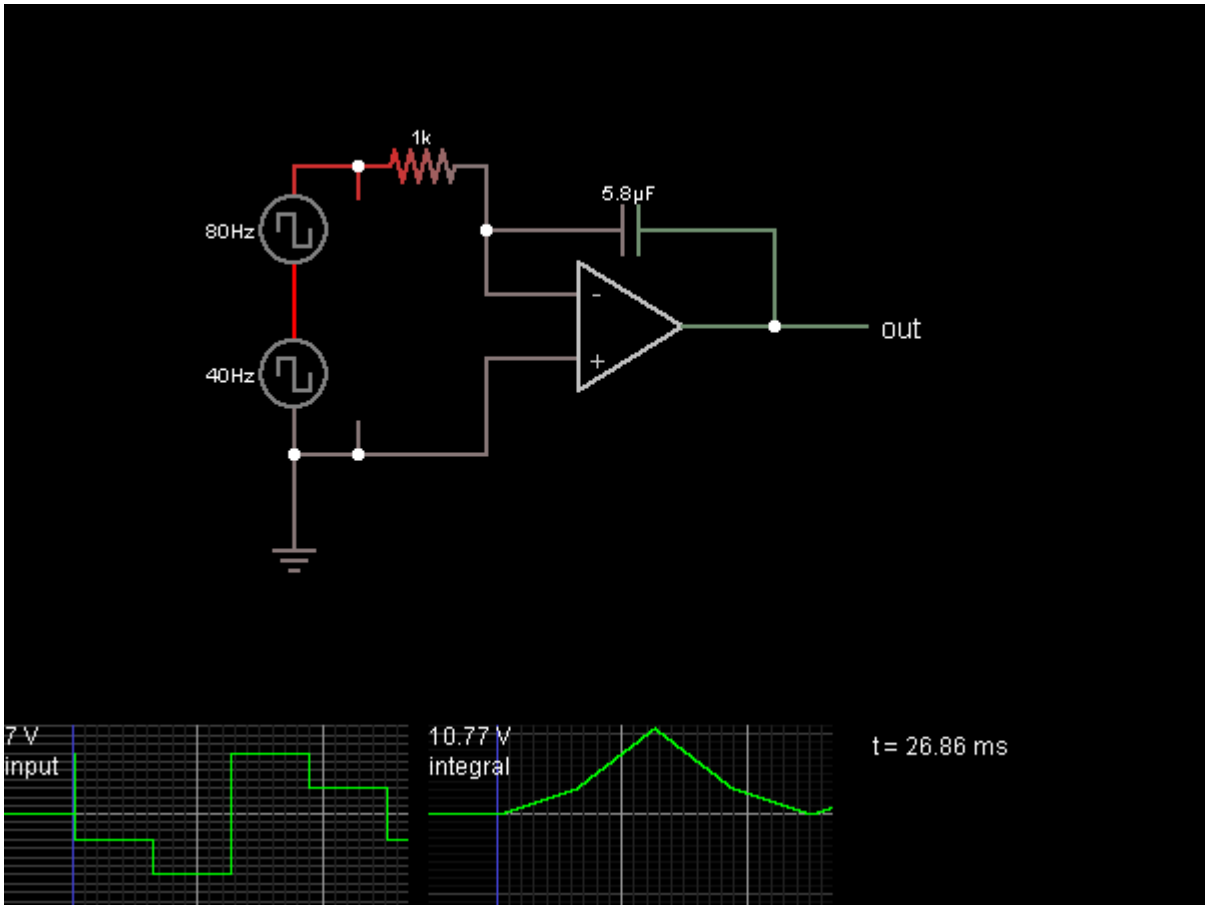
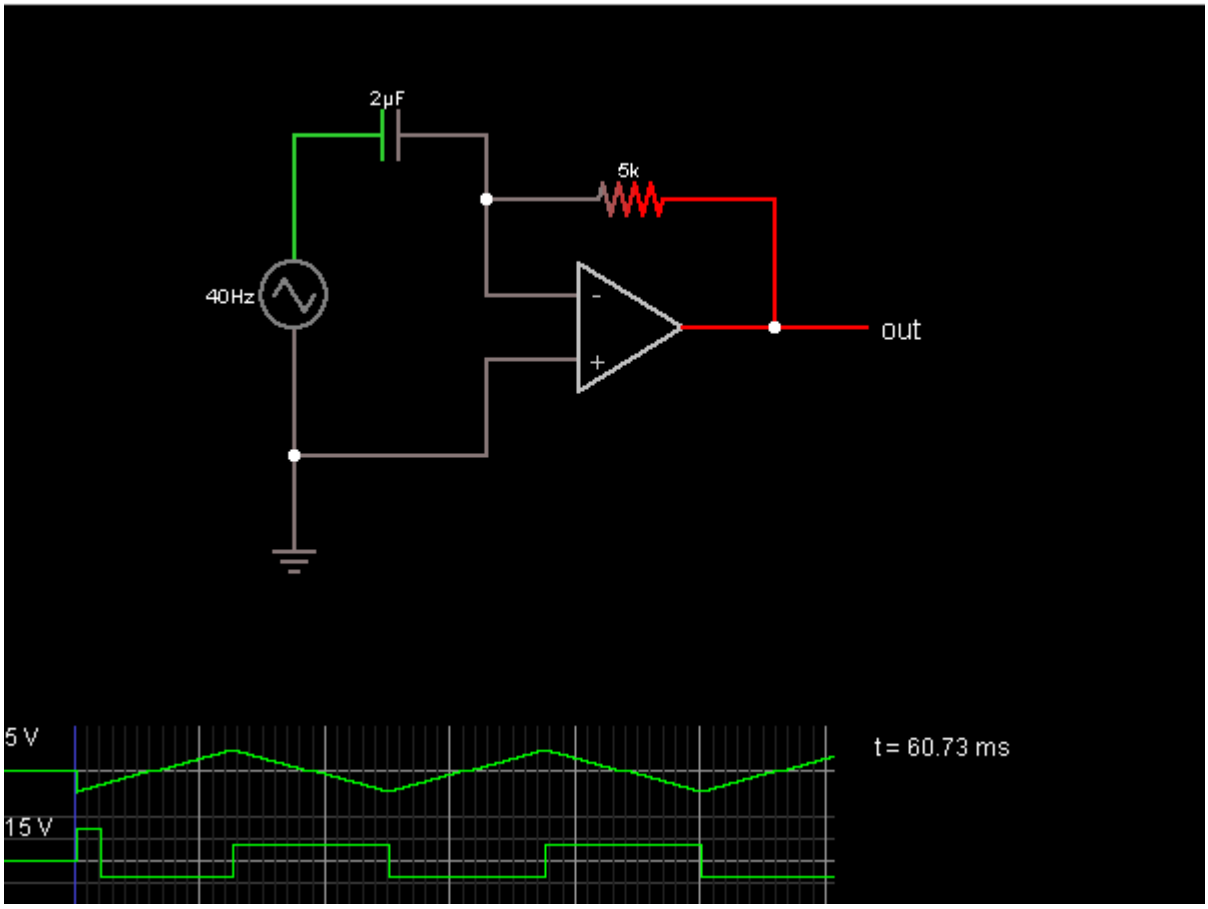
Round 3 Simulation

Max.Time 30 minutes **Simulate output of any one circuit**



1. Circuit Description:Interagator

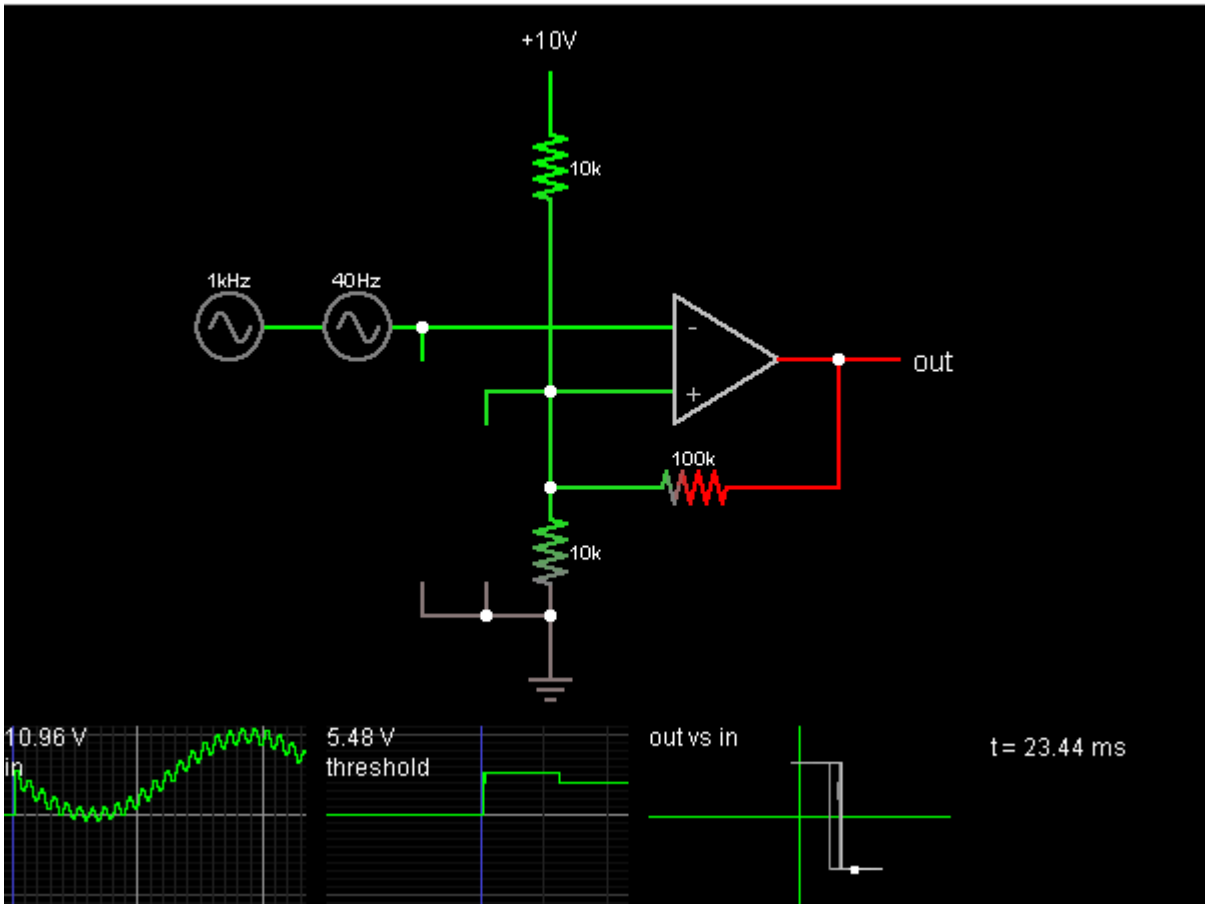
This circuit calculates the integral of the input, meaning that the output voltage changes at a rate proportional to the input voltage (but in the opposite direction). The op-amp attempts to keep its – input at the same voltage as the + input (which is at ground). This requires it to drain an amount of current proportional to the input voltage (V / 1000 ohms). This current goes through the capacitor, whose voltage is proportional to the integral of the current flow through it.



2. Circuit Description: Differentiator (inverting)

This circuit calculates the derivative of the input, meaning that the output voltage is proportional to the (negative) rate of change of the input voltage.

The voltage across the capacitor is proportional to the charge stored in it (the integral of the current). The op-amp attempts to keep its – input at the same voltage as the + input (which is at ground), so the voltage drop across the capacitor must always be equal to the input voltage. This requires the op-amp to have a negative voltage when the input voltage is rising (to drain the capacitor to compensate), and a positive voltage when the input voltage is falling. If the input voltage changes too fast, the op-amp will hit its upper or lower limit and so it won't be able to keep the – input at ground all the time.

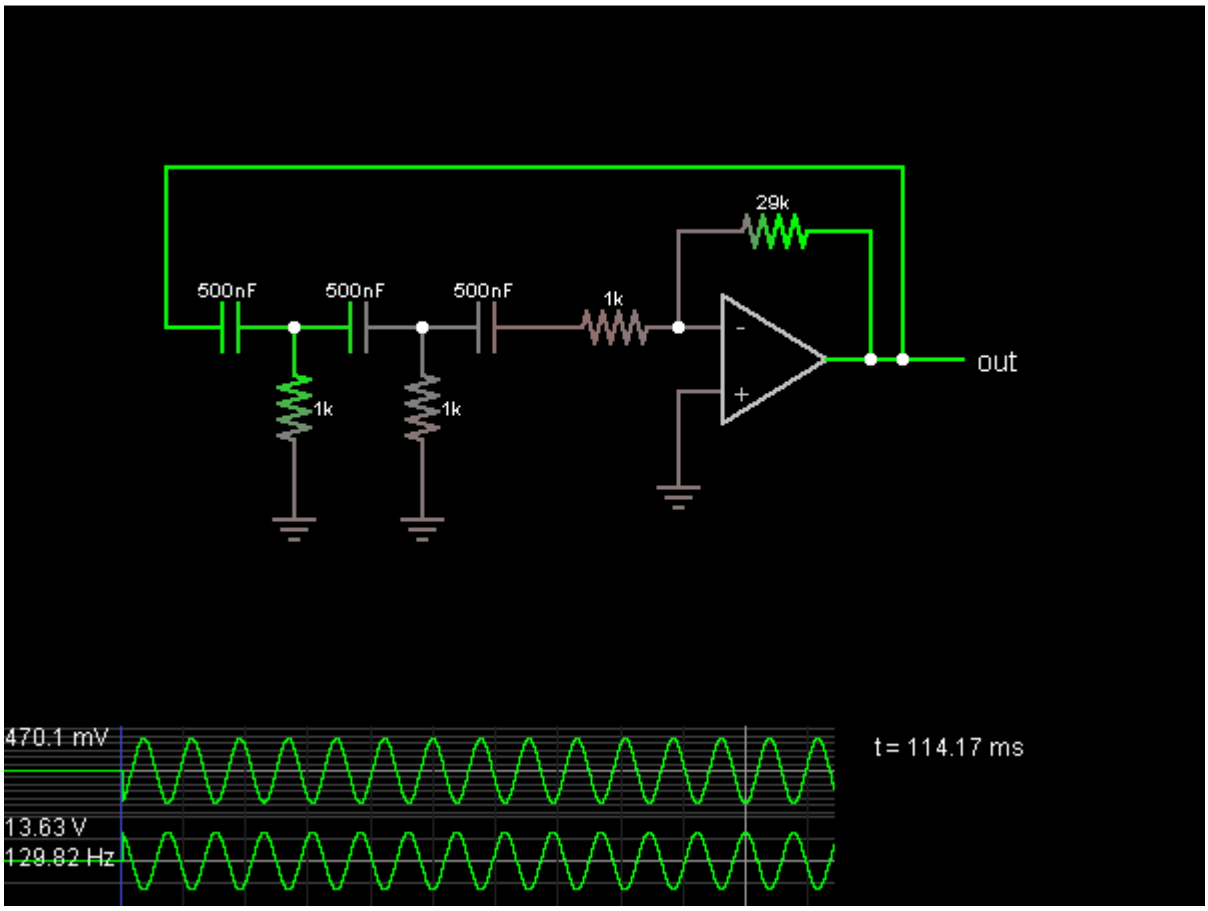


3.Circuit Description: Schmitt Trigger (with op-amps)

This circuit is a Schmitt Trigger, a type of comparator. It measures the input to see if it is above or below a certain threshold. The threshold varies to make it less likely that the output will switch rapidly back and forth due to a noisy input near the threshold.

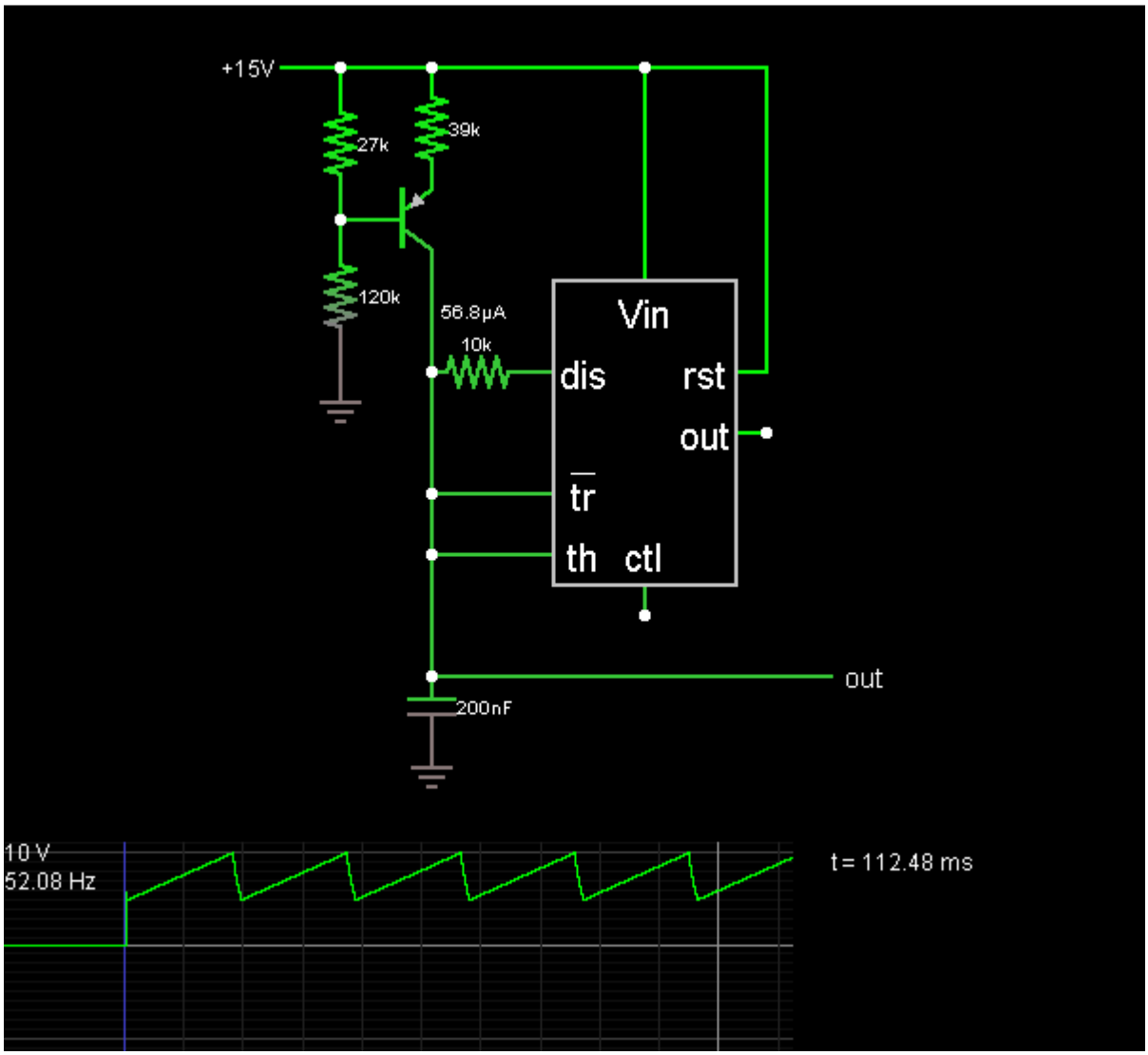
The input is a noisy 40 Hz sine wave, shown in the first scope. The threshold is shown in the second scope. The third scope is a graph of the output versus input. Note that the threshold goes down whenever the input rises above it, and vice versa.

The two 10k resistors form a voltage divider that put the threshold voltage (the + input of the op-amp) at 5 V. But, the output of the op-amp is also connected to the threshold input through a 100k resistor. This causes the threshold to be raised or lowered slightly depending on the op-amp output.



4. Circuit Description: Phase-Shift Oscillator

This circuit is a phase-shift oscillator. The set of three capacitors and two resistors form a filter that shifts their input by 180 degrees at the oscillation frequency. The output of this filter goes into an inverting amplifier, and the output of this amplifier goes back into the filter, providing positive feedback at the oscillation frequency.

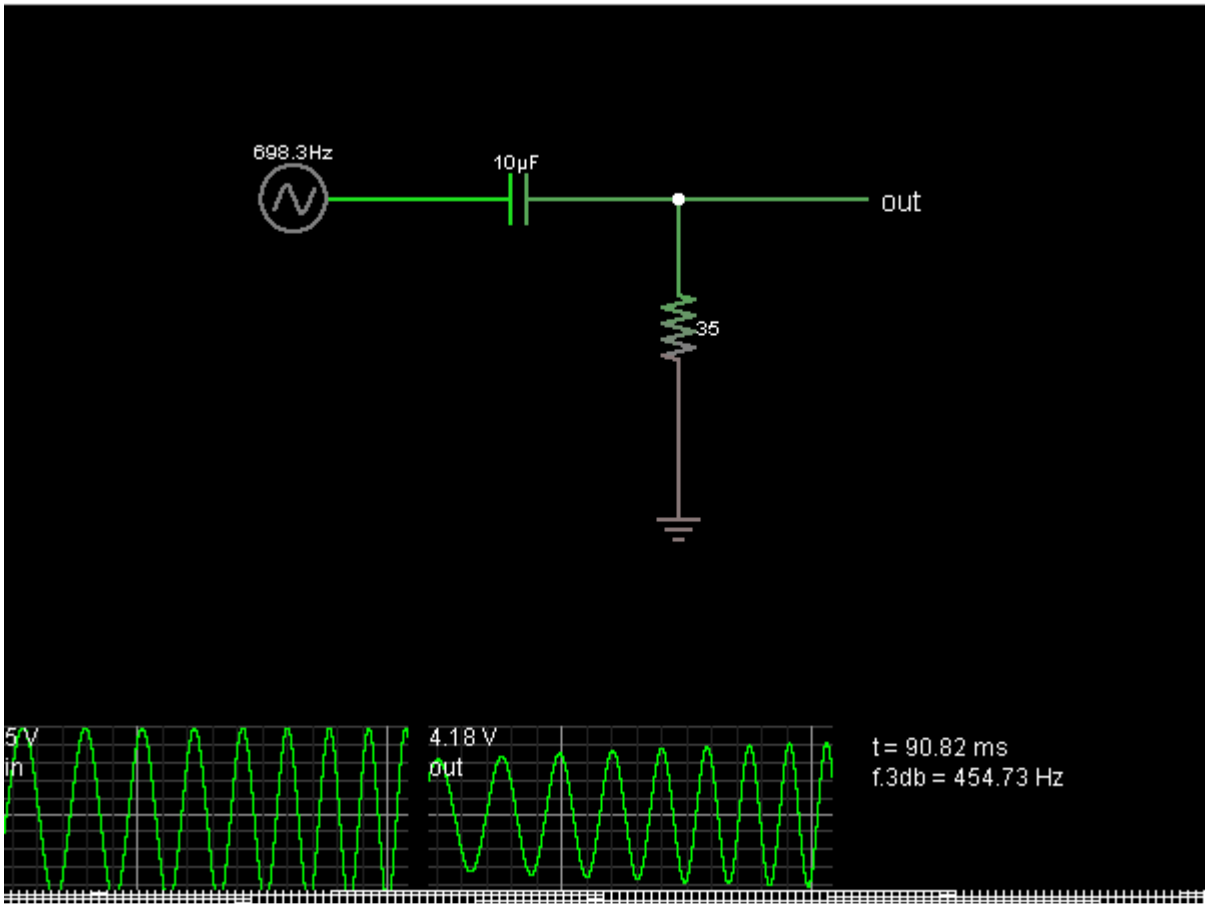


5.Circuit Description: 555 Sawtooth Oscillator

This is a simple sawtooth oscillator using a 555 timer chip.

A timing interval starts when the trigger input ("tr") goes lower than 1/3 Vin, or 3.33V. When this happens, the 555 output goes high, and the 555 waits for the threshold input ("th") to reach 2/3 Vin, or 6.67V. A PNP transistor acts as a current source to steadily charge the capacitor. The threshold input slowly rises until it reaches the required level. Then, the timing interval ends, and the capacitor is quickly discharged through the "dis" input.

When the capacitor is discharged enough so that the trigger reaches 3.33V, then a new timing interval begins. The end result is a sawtooth wave.



Circuit Description:High pass filter RC

This is a high-pass filter implemented using a resistor and a capacitor. A high-pass filter passes higher frequencies and attenuates lower frequencies. The input frequency keeps changing, sweeping up and down the spectrum to demonstrate the change in response. The capacitor passes higher frequencies, causing the output voltage to fluctuate more. Lower frequencies are blocked, and there is reduced current across the resistor, keeping the output voltage closer to ground.

The breakpoint (-3 dB point) is shown at the lower right, as "f.3db".