2nd-Order Sallen-Key Filters

Sallen-Key 2nd-order Low-Pass

Below is a normalized 2nd-order low-pass based on the Sallen-Key (voltage-controlled voltage source, or VCVS) topology. The element values shown are for a cutoff frequency of 1 rad/sec. Note that the damping factor \( d \) in this figure is related to the damping factor discussed in class as \( d = 2\xi \).

Change **FREQUENCY** by varying these two resistors. Keep both these resistors identical in value at all times. A 10:1 resistance change provides a 10:1 frequency change, with the lower resistance values providing higher frequencies.

Change **FREQUENCY** in steps by switching these capacitors. Keep both capacitors identical in value at all times. Doubling the capacitors halves the frequency and vice versa.

Change **DAMPING** by using these two resistors to set the amplifier gain at \((3 - d)\). This is done by making the right resistor \(2 - d\) times larger than the left one. The absolute values of these resistors are noncritical. Ideally the resistance seen on the + and - inputs should be equal for minimum offset.

GAIN of this circuit is fixed at \(3 - d\) or roughly 2:1 (±6 decibels). Adjust signal levels elsewhere in the system.

(Circuit becomes high-pass by switching positions of frequency-determining resistors and capacitors.)

Sallen-Key $2^{\text{nd}}$-order High-Pass

Below is a normalized $2^{\text{nd}}$-order high-pass based on the Sallen-Key topology. The element values shown are for a cutoff frequency of 1 rad/sec. Note that the damping factor $d$ in this figures is related to the damping factor discussed in class as $d = 2\xi$.