Chapter 5 Summary
Analog Signal Processing Using Operational Amplifiers

gain: $$A_v = \frac{V_{\text{out}}}{V_{\text{in}}}$$

op amp ideal model:
1. $I_+ = I_- = 0$
2. $V_+ = V_-$
3. V_{out} is independent of I_{out}
4. negative feedback is required

inverting amplifier: $$\frac{V_{\text{out}}}{V_{\text{in}}} = -\frac{R_F}{R}$$

noninverting amplifier: $$\frac{V_{\text{out}}}{V_{\text{in}}} = 1 + \frac{R_F}{R}$$

buffer/follower: $$V_{out} = V_{in}$$

summer with $R_1 = R_2 = R_F$ $$V_{out} = -(V_1 + V_2)$$

difference amplifier with $R_1 = R_2 = R$:

$$V_{\text{out}} = \frac{R_F}{R}(V_2 - V_1)$$

instrumentation amplifier:

$$V_{\text{out}} = \left[\frac{R_4}{R_3}\left(1 + 2\frac{R_2}{R_1}\right)\right](V_2 - V_1)$$

integrator: $$V_{\text{out}}(t) = -\frac{1}{RC}\int_0^t V_{\text{in}}(\tau)d\tau$$

differentiator: $$V_{\text{out}} = -RC\frac{dV_{\text{in}}}{dt}$$

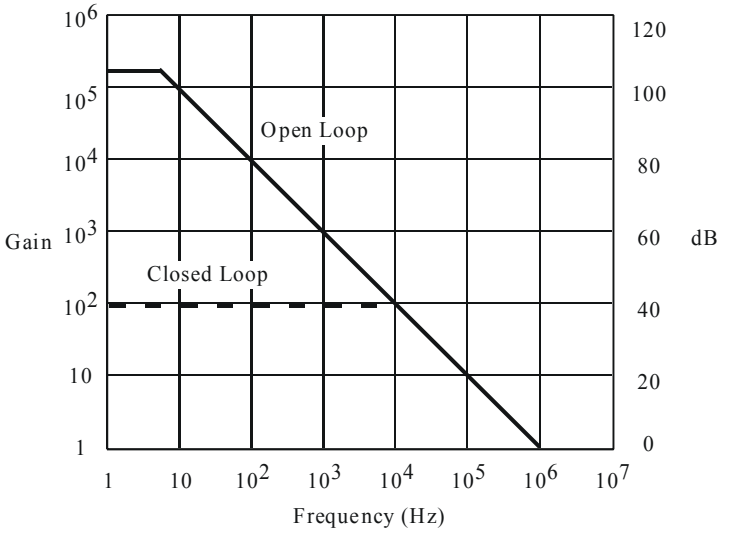
sample and hold: $$V_{out}(t - t_{sampled}) = V_{in}(t_{sampled})$$

comparator: $$V_{\text{out}} = \begin{cases} +V_{\text{sat}} & V_{\text{in}} > V_{\text{ref}} \\ -V_{\text{sat}} & V_{\text{in}} < V_{\text{ref}} \end{cases}$$

real op amp characteristics:

maximum voltage swing: –13.6 V to 13.6 V

frequency response:



maximum output current: $I_{out} < I_{osc}$