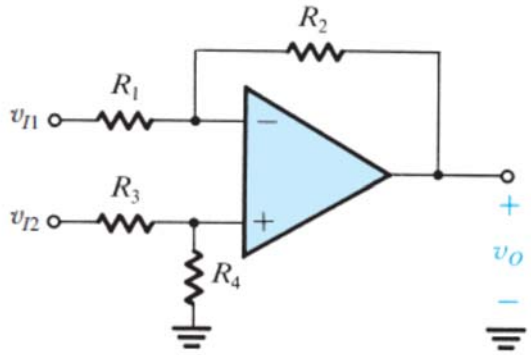
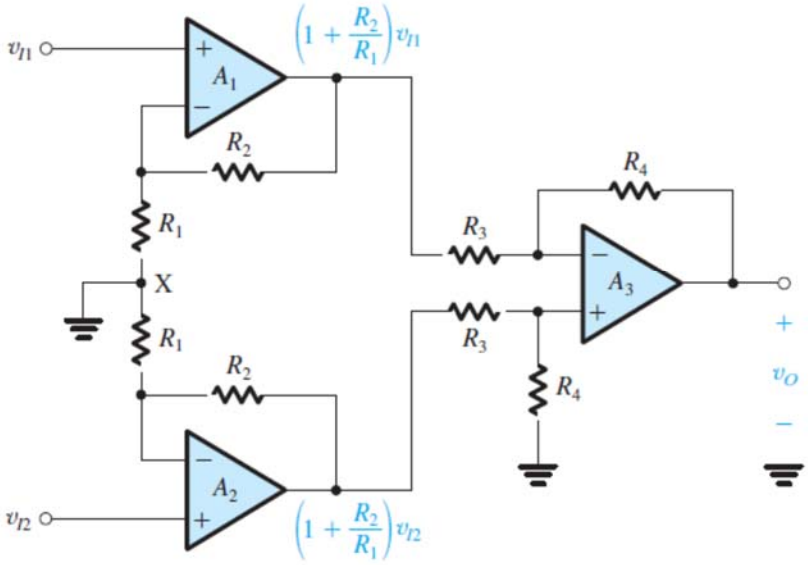
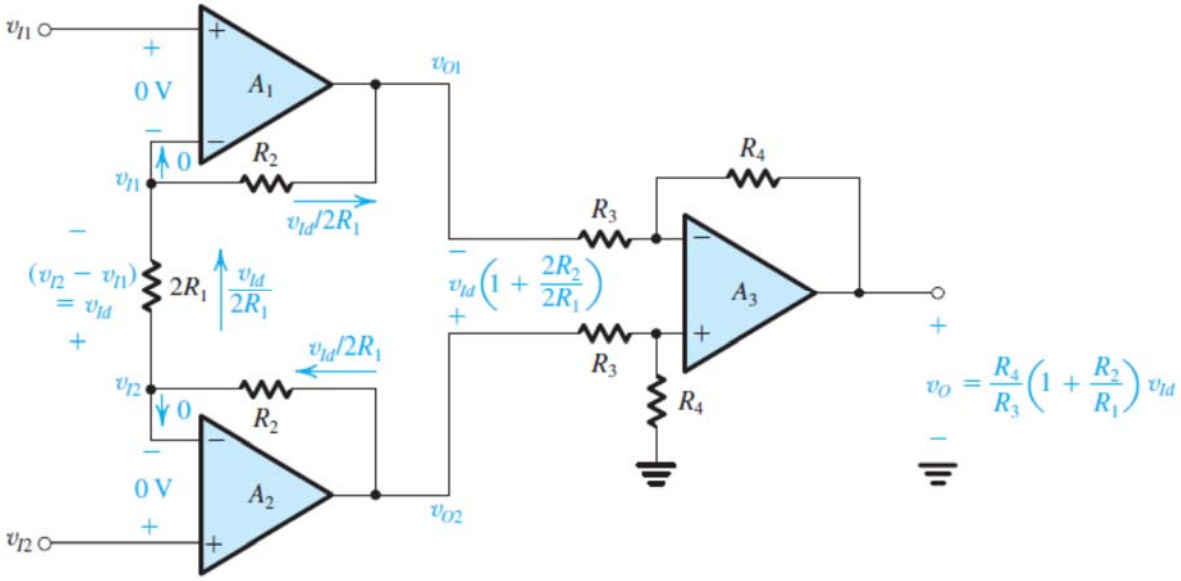
A Superior Circuit—The Instrumentation Amplifier:

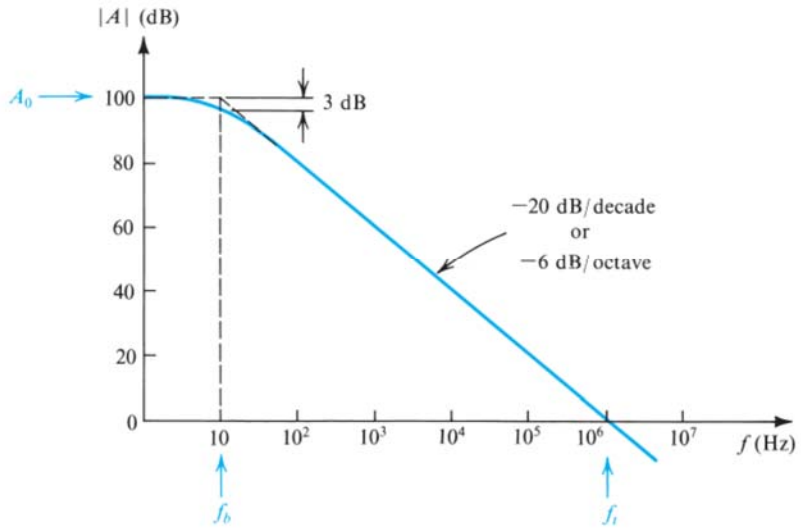




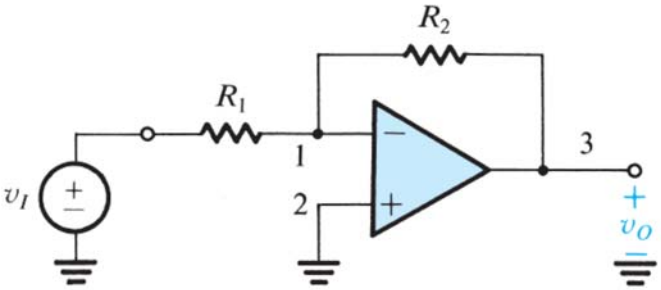


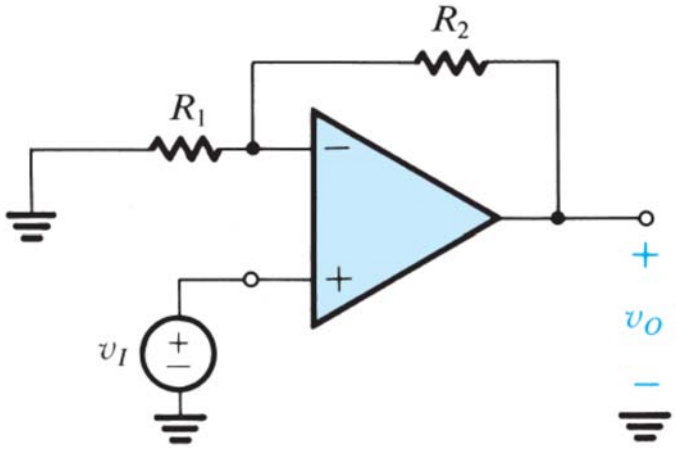
Effect of Finite Open-Loop Gain and Bandwidth on Circuit Performance:

Frequency Dependence of the Open-Loop Gain



Frequency Response of Closed-Loop Amplifiers:



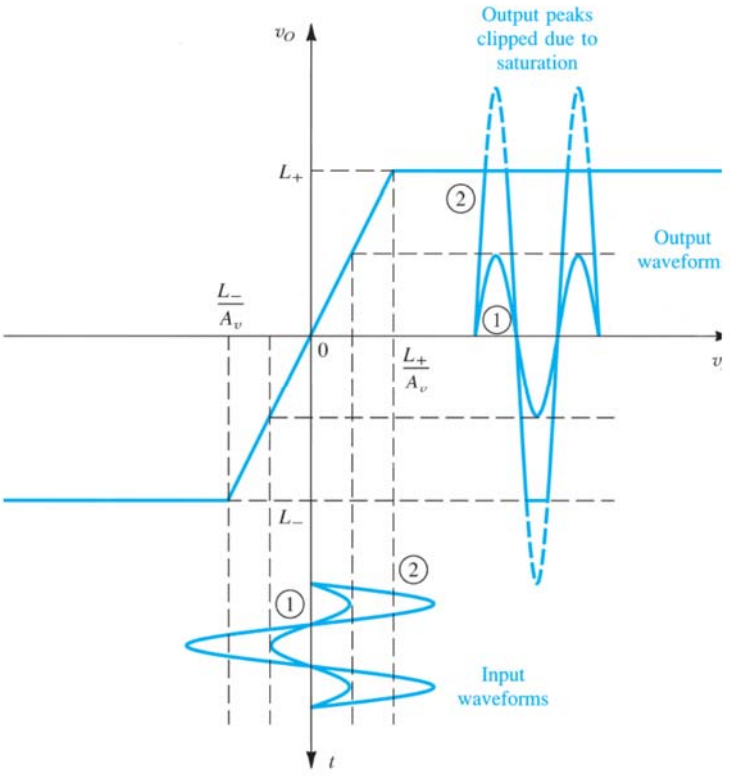


Large-Signal Operation of OpAmps

We look at the limitations on the performance of op-amp circuits when ***large output signals*** are present.

Output Voltage Saturation

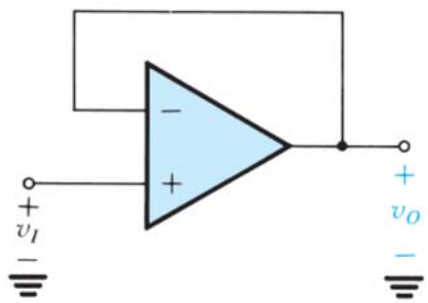
- Similar to all other amplifiers, op amps operate linearly over a limited range of output voltages.

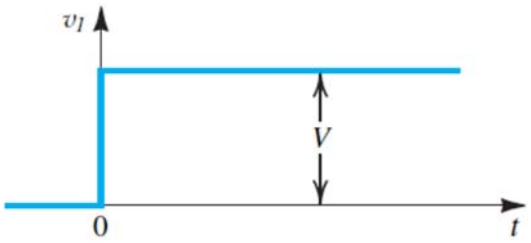


Slew Rate:

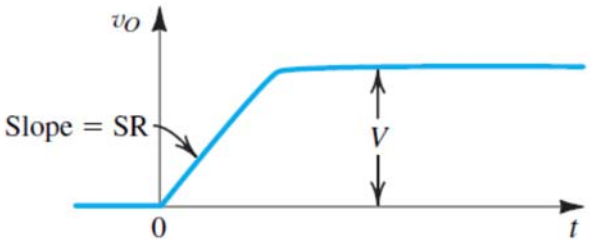
A phenomenon that can cause nonlinear distortion when large output signals are present is slew-rate limiting.

- There is a specific *maximum rate of change* possible at the output of a real op amp and this maximum is known as the **slew rate** (SR) of the op amp and is defined as: $SR = \frac{dv_o}{dt}|_{max}$ and is usually specified on the op-amp data sheet in units of V/μs.
- It follows that if the input signal applied to an op-amp circuit is such that it demands an output response that is faster than the specified value of SR, the op amp will not comply.
- If the output of the op amp will not be able to rise instantaneously to the ideal value V; rather, the output will be the linear ramp of slope equal to SR, shown in fig-c. The amplifier is then said to be slewing, and its output is slew-rate limited.

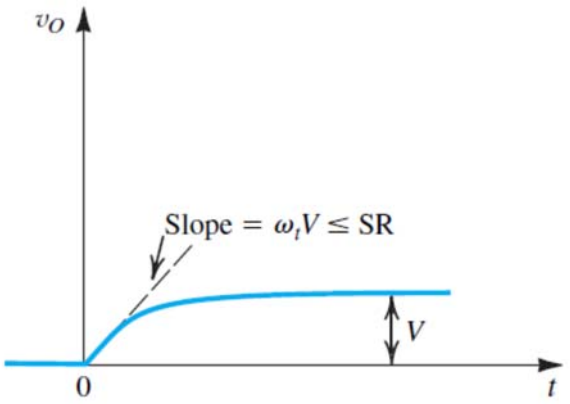




(b)



(c)



(d)