Electronics
Sketching Op Amp Circuit Inputs and Outputs

Terry Sturtevant

Wilfrid Laurier University

September 17, 2013
1 Sketch $V_{in}$. (Show a couple of cycles.)
1. Sketch $V_{in}$. (Show a couple of cycles.)
2. Sketch output lightly with correct sign, based on sign of gain.
Sketch $V_{in}$. (Show a couple of cycles.)

2 Sketch output lightly with correct sign, based on sign of gain.

3 Scale vertical axis based on magnitude of gain.
1. Sketch $V_{in}$. (Show a couple of cycles.)
2. Sketch output lightly with correct sign, based on sign of gain.
3. Scale vertical axis based on magnitude of gain.
4. Clip signal (if necessary) based on rails.
Example:

5V, 1kHz sine wave is fed into an inverting amplifier. $R_f = 8k\Omega$, $R_i = 2k\Omega$, Positive supply is at 10V, Negative supply is at $-5V$. 

Terry Sturtevant
Electronics Sketching Op Amp Circuit Inputs and Outputs
Example:

- 5V, 1kHz sine wave is fed into an inverting amplifier.
Example:

- $5\text{V}, \ 1\text{kHz}$ sine wave is fed into an inverting amplifier.
  - $R_f = 8k\Omega$,
Example:

- 5V, 1kHz sine wave is fed into an inverting amplifier.
  
  \[ R_f = 8k\Omega, \]

  \[ R_i = 2k\Omega, \]
Example:

- 5V, 1kHz sine wave is fed into an inverting amplifier.
  - $R_f = 8k\Omega$,
  - $R_i = 2k\Omega$,
- Positive supply is at 10V,
Example:

- 5V, 1kHz sine wave is fed into an inverting amplifier.
  \[ R_f = 8k\Omega, \]
  \[ R_i = 2k\Omega, \]
- Positive supply is at 10V,
- Negative supply is at −5V,
Example:

- 5V, 1kHz sine wave is fed into an inverting amplifier.
  \[ R_f = 8k\Omega, \]
  \[ R_i = 2k\Omega, \]
- Positive supply is at 10V,
- Negative supply is at −5V,
First: Determine gain:

\[ \frac{V_o}{V_i} = -\frac{R_f}{R_i} \]

So, for our circuit,

\[ \frac{V_o}{V_i} = -\frac{8 \text{k}\Omega}{2 \text{k}\Omega} = -4 \]

The gain is \(-4\).
First: Determine gain:

- For an inverting amplifier,
First: Determine gain:

- For an inverting amplifier,
  \[ \frac{V_o}{V_i} = -\frac{R_f}{R_i} \]
First: Determine gain:

- For an inverting amplifier,
  \[ \frac{V_o}{V_i} = -\frac{R_f}{R_i} \]
- So, for our circuit,
First: Determine gain:

- For an inverting amplifier, 
  \[ V_o/V_i = -R_f/R_i \]
- So, for our circuit, 
  \[ V_o/V_i = -8k\Omega/2k\Omega \]
First: Determine gain:

- For an inverting amplifier,
  \[ \frac{V_o}{V_i} = -\frac{R_f}{R_i} \]
- So, for our circuit,
  \[ \frac{V_o}{V_i} = -8\,k\Omega/2\,k\Omega \]
  \[ = -4 \]
First: Determine gain:

- For an inverting amplifier,
  \[ V_o/V_i = -R_f/R_i \]

- So, for our circuit,
  \[ V_o/V_i = -8k\Omega/2k\Omega \]
  \[ = -4 \]

- The gain is \(-4\).
Sketch $V_{in}$. 
Create axes for $V_{out}$. (Use critical points for alignment.)
Sketch shape of $V_{out}$ with *sign* of the gain. (inverted in this case.)
Use \textit{magnitude} of gain to make scale for $V_{out}$. (magnitude of 4.)
Adjust top of waveform for positive rail. (+10V)
Adjust bottom of waveform for *negative* rail. (-5V)
Clean up by removing obsolete lines.
Review

1. Sketch $V_{in}$. (Show a couple of cycles.)
2. Sketch output lightly with correct sign, based on sign of gain.
3. Scale vertical axis based on magnitude of gain.
4. Clip signal (if necessary) based on rails.
Review

1. Sketch $V_{in}$. (Show a couple of cycles.)
Review

1. Sketch $V_{in}$. (Show a couple of cycles.)
2. Sketch output lightly with correct sign, based on sign of gain.
Review

1. Sketch $V_{in}$. (Show a couple of cycles.)
2. Sketch output lightly with correct sign, based on sign of gain.
3. Scale vertical axis based on magnitude of gain.
Review

1. Sketch $V_{in}$. (Show a couple of cycles.)
2. Sketch output lightly with correct sign, based on sign of gain.
3. Scale vertical axis based on magnitude of gain.
4. Clip signal (if necessary) based on rails.