Basic Waveforms and Oscilloscope Operation

ECE 2100 Circuit Analysis
updated 24 February 2020

Pre-Laboratory Assignment

1. Go to the website https://www.tek.com/oscilloscope-tutorial and download the XYZs of Oscilloscopes Primer by Tektronix. Read (page numbers as in the document, not as listed by the pdf viewing program): “The Oscilloscope” section pages 7-12 and “The Systems and Controls of an Oscilloscope” section pages 19-33.

2. In one paragraph (use proper English): what is the basic purpose of an oscilloscope?

3. In one paragraph (use proper English): what is the difference between AC and DC coupling?

4. In one paragraph (use proper English): what is the purpose of the trigger system?

Procedures

Part One

1. Connect the waveform generator to CH 1 of the oscilloscope. Adjust the waveform generator controls to display a voltage of the form

\[ v(t) = 1 + \sin(2\pi1000t) \text{ (V)} \]

Trigger the oscilloscope from CH 1 and adjust the trigger level as needed to obtain a stable display. Adjust the horizontal axis time scale to display at least two cycles of \( v(t) \). Adjust the vertical axis voltage scale to use as much of the graph area as possible while still viewing the entire waveform. Use the oscilloscope cursors to carefully insure that the generator is producing an accurate \( v(t) \). Carefully sketch the waveform in your lab notebook; your graph must show the same axis ticks as shown on the scope display.

BEFORE PROCEEDING TO THE NEXT STEP ask the lab instructor to verify your setup.

2. Connect the built-in oscilloscope square wave signal (available on the front panel) to CH 2 of the oscilloscope. Readjust the vertical axis voltage scale so that all parts of the two waveforms are visible.

3. Are both waveforms “stationary?” Why or why not? Slightly adjust the frequency of \( v(t) \) to try to obtain stationary waveforms. Note the behavior of the displayed waveforms.
Part Two

4. Switch the trigger source to CH 2 and adjust the trigger to stabilize the CH 2 waveform. Set the trigger system to first trigger on the rising signal edge and then on the falling signal edge. Describe the change in the displayed waveform.

5. Lower the horizontal time axis scale to reveal that the CH 2 square wave is not really a square wave after all! How long does the square wave take to transition from one voltage level to another? Use the oscilloscope cursors to measure this time. Sketch the waveform shape in your lab notebook using the same axis ticks as shown on the scope display. Be sure to note the horizontal and vertical scale settings.

Part Three

6. Adjust the trigger controls to obtain a stationary display of \( v(t) \). Change the input coupling from DC to AC. Describe the effect.

Part Four

7. Remove the input to CH 1.

8. Short the input to CH 1 by attaching a wire across the scope leads using a wire at least 15 cm long. Adjust the vertical axis voltage scale to display the voltage across this supposed short. Is the voltage zero? Describe the observed waveform.

Part Five

9. Use the waveform generator to display a triangular voltage waveform of your choosing. Document your work.

Analysis

1. Under what conditions would you be able to observe every cycle of a periodic waveform using an oscilloscope?

2. How could an oscilloscope be used to display current waveforms instead of voltage waveforms? What constraints apply to your current measuring method?

3. What might be some sources of the voltage waveform observed in laboratory procedures step 8?

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