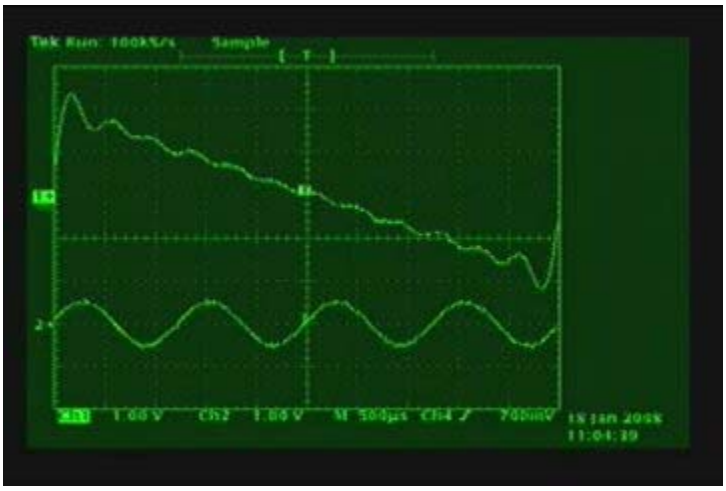
Question #330

Shown in the top trace of the oscilloscope photograph below is a sawtooth wave synthesized from its first twelve harmonics. The lower trace shows the fourth harmonic. Click on the photograph to hear the sound of the sawtooth wave.



This question investigates the effect of changing the amplitude and phase of any harmonic on the sound of the wave.

Part 1: Suppose that we were to change the amplitude, but not the phase, of the fourth harmonic. All of the other harmonics in this synthesized sawtooth wave will remain the same. How does such a change affect the shape and sound quality, or timbre, of the wave?

When the amplitude of the fourth harmonic is varied:

- (a) only the wave shape of the sum wave will change.
- (b) only the timbre of the sum wave will change.
- (c) both the wave shape and the timbre of the sum wave will change.
- (d) neither the wave shape nor the timbre of the sum wave will change.

Part 2: Suppose that we were to change the phase, but not the amplitude, of the fourth harmonic. Again, all of the other harmonics in this synthesized sawtooth wave will remain the same. How does such a change affect the shape and timbre of the wave?

When the phase of the fourth harmonic is varied:

- (a) only the wave shape of the sum wave will change.
- (b) only the timbre of the sum wave will change.
- (c) both the wave shape and the timbre of the sum wave will change.
- (d) neither the wave shape nor the timbre of the sum wave will change.

Click here for Answer #330 after December 8, 2008.

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For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.