

Re: Sine wave construction using calculus or some approximation thereof – question.

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jhuie wrote:

Interesting. I've been looking at some of the examples and it's fascinating. The main reason I've been curious is because I thought you could make up a function from a series of smaller (lower amplitude) waves. But I'm not sure that's true by looking at the examples.

Because "adding up small waves to make big waves" is not what Fourier series is all about. What Fourier series says is that a wave with one frequency, no matter what the shape, is made up mostly of a "fundamental" low frequency plus harmonics.

Synthesizers (electronic music) use this principle. If you want to make the sound of a trumpet blowing A 440 Hz, first you start with a sine wave of 440 Hz, then add the right amounts of 880 Hz, 1320 Hz, 1760 Hz, etc (all multiples of 440). There's more they do to it these days to make it sound more realistic, but that's the basic idea.

But probably that first 440 Hz sine wave is just about as loud as the total sound you want to put out.

In terms of an example, say you had 1,000 tiny speakers. Could you somehow arrange those and control them with a computer so that they "add up" to create the sound of one large speaker?

Yes, sort of. You could arrange things so that at certain places the sounds added up in phase in what is called "constructive interference", like here:

<http://scienceworld.wolfram.com/physics/ConstructiveInterference.html>

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So it would be very loud in some places. But what happens then is it is very quiet in other places.

Could you somehow approximate a very low note from a combination of speakers that individually can only produce high notes? See where I'm going with this?

I don't. Neither Fourier series nor constructive interference talks about using higher frequencies to make lower ones. Note that in my trumpet example, I used 440 Hz (plus other stuff) to make 440 Hz. And in the constructive interference example, identical signals are adding up to make a larger version of the same signal, all at the same frequency.

Someone else has suggested using the phenomenon of "beats", which produces low frequencies from higher ones.

– Randy

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