
Subject: Re: Kinda reproducing a square wave
Posted by [Tom Danley](#) on Thu, 18 Mar 2004 15:33:14 GMT
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Hilt is true that in extreme "fundamentalists" view, a square wave cannot be re-produced by any speaker, or even produced in the first place by any real world electronics, passed by any cable or be realized by physical action.. Every thing we deal with in the real world (outside of fundamental theory) has a high frequency limit and so a finite slew rate and so cannot instantly go from one value to another without traversing the area in between. On the other hand, a square wave has been used in electronics as an analytical signal for at least a half century because it is simple to see and is effected by a signal bandwidth much much larger than the repetition rate suggests. The rule of thumb in electronics is that one needs about a factor of 10 in flat amplitude and phase in each direction past the center frequency in order to have a good looking square wave on an oscilloscope (a standard instrument which displays a signal voltage over time). This would mean that for a speaker that was flat in amplitude AND had zero degrees phase from 20 Hz to 20KHz, that it would satisfy the requirements of producing a square wave from about 200 Hz to about 2000Hz. This would also be just as true for any part of the chain like a CD player or amplifier. Part of what makes it useful is after learning to interpret it. For example in a "simple" system, the rise and fall times are directly related to the high frequency response while any tilt in the "flat parts" is governed by the low frequency response. Phase shift will alter the position of the slew within the waveshape as well as determine the final shape. While consideration of a square wave or the idea of preserving the waveshape of the input signal are two ways to look at it, there is another, that is time. If one fed a speaker an imaginary signal that covered a wide frequency bandwidth and then looked at the sound as it emerged from the speaker, one finds the speaker spreads the signal out in time if it is not able to preserve the waveshape. In other words, the original waveshape or impulse occupies X time, if the speaker cannot preserve the waveshape, it is also spreading the signal out in time and / or is altering the time relationships between various parts of the spectrum. The Manger remains the "best" speaker in time I have ever measured although it is not a "clean" speaker or suited to high level operation unless one is insensitive to large amounts of harmonic distortion. At least to me, I see anything that alters the original signal significantly as distortion, this includes the popular harmonic distortion, but also amplitude distortion and being dispersive in the time domain. Cheers, Tom
