Subject: Re: Can't reproduce a square wave
Posted by Tom Danley on Thu, 18 Mar 2004 16:53:58 GMT
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Hi WayneInside a sealed box speaker, the pressure wave shape IS exactly related to the displacement. If one wanted a square wave pressure in a box, the cone has two positions, in or out with a fast transition between.If you placed this box in an air tight room and operated it at a frequency where you are much lower than the lowest room resonance, one also finds the sound pressure out side the box IS also related to the displacement.On the other hand, if one were in full or fractional space or in a room well above the lowest room resonance, then the conditions are different.Radiated acoustic power from an acoustically small source (like a woofer) is NOT displacement but Volume velocity.For a sine wave (easy to picture) signal, in a sealed box or acoustically small room (as above), one finds the pressure is "in phase" with the displacement.Easy to imagine the woofer's outward position is compressing the air in the room etc.Once one is outdoors or higher up in frequency in the room, one finds the radiated pressure is actually 90 degrees from the displacement,That is to say, the greatest positive and negative radiated pressures coincide with the driver when it is at ZERO displacement (because that is where its radiator velocity (and there for volume velocity) is highest).So far as audibility of waveshape preservation and adaptive crossovers, it turns out there are a few others interested in this.http://www.ocf.berkeley.edu/~ashon/audio/phase/phaseaud2.htmHere is a fellow on the same "non-integer" crossover path as used on the Unity's we discussed some long time back.http://www.geocities.com/kreskovs/John1.htmlIf you are going to LasVegas for the NSCA trade show this week end, you could stop at our booth and hear a speaker that does a decent job with preserving waveshape (within band) and see if it sounds any different.I would bet that it is the acoustic transition from pressure to volume velocity that is the part you refer to as a differentiator, I can see that it could look like that..As in your (1st order) differentiator example, there is also the 90 degree phase shift going between pressure and volume velocity parts of the radiator motionYou are correct also that the piston motion does have to follow a path that results in a radiated "square wave" or other complex signal and that this is not the same shape as the acoustic pressure (because it is the volume velocity or Uo, not displacement or position which radiates acoustic power.)For a square wave of any frequency radiated into some space (that is not acoustically small and contained), a constant radiated pressure requires a constant volume velocity, a constant velocity (with periodic reversals) traces out a triangle wave, that is the needed piston motion if radiating a square wave into space.There is no frequency limitation on a square wave here other than (the bandwidth requirement as in the other post and) a pressure / frequency one set by the maximum displacement and driver linearity.Cheers,Tom