Subject: Re: Time Alignment
Posted by Wayne Parham on Wed, 04 Oct 2006 20:01:12 GMT
View Forum Message <> Reply to Message

In my experience, use of the phrase "time alignment" has always been a marketing device. It isn't realistic to expect perfect phase alignment across the audible spectrum. On the other hand, it is important to have sound sources acoustically phased so that they do not cancel, which means

components and by electrical and mechanical properties of each driver. It is also affected by the acoustic properties of the speaker cabinet. Phase is a type of delay that is related to wavelength, and can be described as an angle from 0 to 360°. The delay can also be expressed as a percentage of cycle time, 180° phase shift being 1/2 cycle, for example. Driver position can cause a different kind of delay, one that is fixed rather than being a percentage of each cycle. If the tweeter is behind the woofer, then the sound reaching your ears is delayed by a fixed amount of time, according to the distance and the speed of sound.The two kinds of delay aren't the same thing, and so one can't necessarily be used to offset the other. If a sound source is phase shifted 90°, then the delay changes with respect to frequency. A 90° phase shift of a 100Hz signal is equivalent to about 2.5mS, which is how long sound takes to travel roughly 2.8 feet. From these calculations, you can see that as long as sound sources are within 2.8 feet of each other, they'll

shifted 90°, the equivalent delay is only 1.2mS and the equivalent offset is only 1.4 feet. At 1kHz the delay coresponding to 90° is 250µS having an equivalent offset of 3.4 inches. At 10kHz, it's 25µS and 0.34". So you can see that phase is different than fixed delay. If you have fixed phase offset, you have moving delay. Likewise, if you have a fixed delay, you have moving phase.All these facts notwithstanding, you can still design a speaker so that the maximum phase shift between two adjacent sound sources is 90° This can be accomplished using electrical phase shifts and/or delays, by physical placement or by a combination of each. It is not a trivial matter, and perfect phase alignment is not possible because of the physical properties of the system. But ideally, you can design a speaker so that overlapping sound sources are phased

placement of the drivers vertically aligned so that horizontal movement does not change the distance between the listener and the speaker drivers. Physical offset front to back is important as is crossover phasing, with drivers aligned vertically for uniform coverage along the horizontal plane.