Subject: Dense Interference
Posted by Wayne Parham on Fri, 02 Oct 2009 18:24:48 GMT
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Look at the concept of dense interference. When several acoustically distant sound sources (direct and/or reflected) combine, some constructively, some destructively and some in-between, what you have at any given listening position is neither a full cancellation (notch) nor full constructive summing (+6dB per doubling). Instead, you have an averaging effect. This is more like statistical energy distribution than it is like wave summing. It isn't two waves combining to make a clearly defined summed wavefront, larger or smaller depending on the phase between the two sources, rather it is more like the pattern formed by rain drops on the sea.

This is why an array sounds like it is attenuated at higher frequencies. At low frequencies, the drivers sum contructively providing 6dB more for each doubling of drivers. As frequency rises, as it approaches the range where distance is about a wavelength, clearly defined comb filter patterns begin to form. There are positions where cancellation notches form adjacent to positions where there are peaks from constructive summing. Those lobes and nulls are clearly audible as the listener passes through them. But as frequency goes higher still, the distance between lobes and nulls becomes so closely packed together you can't tell them apart from one another. They start to act more like an averaged sound field. This is dense interference, and all you really notice is a slight reduction in amplitude compared to the low frequency level, where summing is constructive.

Dense interference is what smoothes room modes when using multiple subs and it is also what causes the floor bounce notch to be mitigated by a standing line array. In a sense, what you are doing with these arrangements is avoiding the middle region where lobes and nulls are clearly distinguishable. While I think the best goal is to have constructive summing from a tight grouping of sound sources that are acoustically close, where that's not possible (indoors), dense interference is the next best thing. Since reflections make phantom sources that are acoustically distant, I see some benefit in using dense interference in some cases to smooth the average sound field, especially at low frequencies where lobes and nulls are far apart enough to be clearly distinguishable.