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Subject: Re: Flanking Subs vs Helper Woofers  
Posted by [andy\\_c](#) on Fri, 01 Feb 2013 20:12:56 GMT  
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Wayne Parham wrote on Wed, 23 January 2013 11:57

And Welti added a processor box that equalized the response sent to each subwoofer using FIR filters, calling this technique "sound field management". Now Geddes has begun to employ this approach as well.

Hi Wayne,

The situation regarding Harman and multiple subs has been somewhat confusing. The first multi-sub processor box they made that I'm aware of was the BassQ. As far as I can tell, it used FIR filters and a pretty sophisticated algorithm for computing them, based on measurements at multiple listening positions. But the article by Welti and Devantier describing Sound Field Management (SFM), Low-Frequency Optimization Using Multiple Subwoofers, describes a technique that's different from what BassQ uses. In fact, I was pretty surprised at how crude the method is. For each sub, there is a variable gain and delay, but only a single biquad IIR filter: a cut-only parametric EQ stage. For each subwoofer, the gain, delay, and biquad parameters are configured so as to minimize the variation in frequency response with position of the combined subs, without regard to what the frequency response is. They assume that global EQ will then be used to clean up the response. SFM is used in the ARCOS system (which also implements global EQ). Confusingly, the sub-blending approach of the BassQ looks to be much more sophisticated than what ARCOS is doing. BassQ seems to be computing its filters using the matrix inversion approach described in the above Welti and Devantier article (but not used for SFM).

It looks like what Earl is doing is much more sophisticated than ARCOS regarding the blending of the subs as well, though probably not as complex as the BassQ processing. The strange curves he gets at around 32 minutes into his presentation show that his filters are fairly high-order, though it's hard to tell exactly what the filter order is.

I am also fascinated by the history of the multi-sub approach, but somewhat puzzled by why Harman did not continue with the approach used by the BassQ.

Edit: It may also be that I'm overestimating the complexity of the BassQ, as there hasn't been much information disclosed about it by Harman.

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