Virtual Education Lab: Evolution of the optimal reflection phase grating diffusor

In the last 4 posts, we have explained how to minimize the limitations of an array of number theoretic diffusors, like a QRD. These improvements included:
1. Expanding the bandwidth via a fractal design
2. Creating an aperiodic array to replace a periodic repetition, which minimizes grating lobes
3. Optimizing the integer-related well depth sequence, which causes flat plate frequencies

This chronological evolution is illustrated in Figure 1.

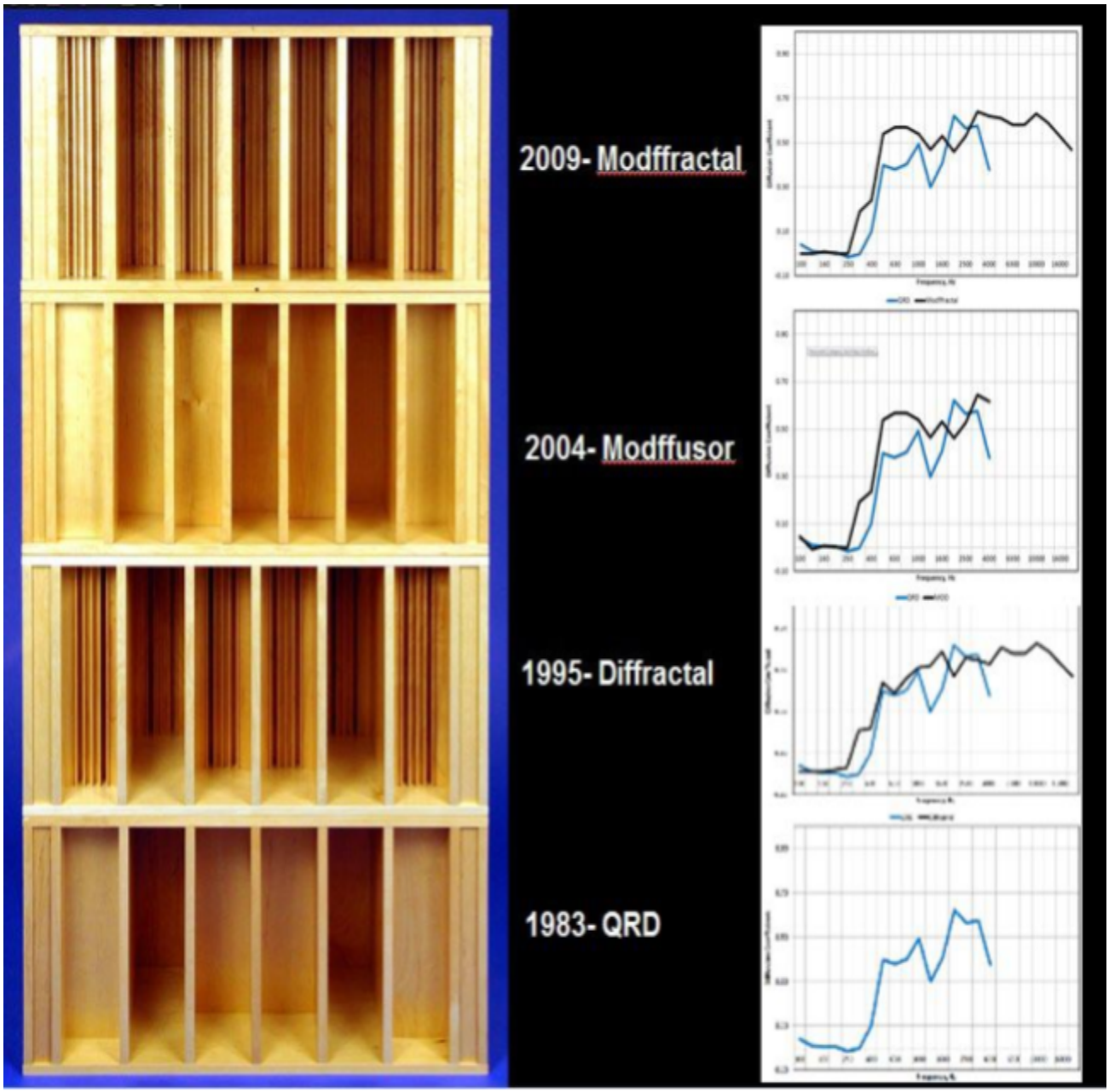

Figure . Evolution of the optimal reflection phase grating diffusor with comparative diffusion coefficients.

To summarize, for optimal performance, the current state-of-the-art suggests that one should utilize an optimal binary sequence modulated, aperiodic array of asymmetric broad bandwidth diffusors with non-integer related well depths.

In 1983, the QRD was introduced and made a significant contribution to architectural acoustics, but it had limited bandwidth.

In 1995, the bandwidth of the QRD was extended, using a self-similar fractal design to create the Diffractal.

In 2004, the integer-related well depths were replaced with an optimal sequence of non-integer-related well depths, through the use of a new wave acoustics-based Boundary Element Method iterative Shape Optimizer program. Thus, creating the asymmetric, Modulated Optimized Diffusor, Modffusor, which could be modulated into an aperiodic array, using an optimal binary sequence, like a Barker code.
Finally, in 2009, the bandwidth of the Modffusor was improved, using the fractal design of the Diffractal to create the Modffractal, which is the zenith in the evolution of the reflection phase grating diffusor.

In the next post, having completed our analysis of reflection phase gratings, we begin a new series describing how the Shape Optimizer can be used to optimize curvilinear shapes, introducing a new diffusing aesthetic to architectural acoustics.

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