Diffuse Reflections

The Newsletter for Progressive Acoustics Research Volume 3, Issue 2, 1997

Introducing SilentSteps™- a new pre-stressed concrete acoustical seating riser system for arenas

IN THIS ISSUE

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DIFFUSE NEWS

Dr. Peter D'Antonio
President/CEO

Thanks for the enthusiastic response to our new Newsletter. Our Shape Optimization service seems to be promoting a vigorous and synergetic exchange of ideas. I have really enjoyed the interaction with consultants around the world and invite all of you to take advantage of this powerful new AcousticTool®. We will be providing case studies in our R&D section to illustrate the many opportunities optimization offers. You may also consult our web site for further information.

CONFERENCES

RPG participated in the following conferences:

AES, LONDON: *"Characterization of Acoustical Materials"* described the challenges in developing a diffusion coefficient and the status of the EPSRC grant.

INSTITUTE OF ACOUSTICS, BELFAST: *"Designing Stage Canopies for Improved Acoustics"* described the use of our Shape Optimizer™ to design stage canopies, which provide optimum stage/audience coverage. *"Diffusion Parameters for Auditorium Surfaces"* described progress on the EPSRC grant, which RPG has co-funded to develop an industry standard diffusion coefficient.

AES, NEW YORK: *"Optimized Loudspeaker/Listener Placement Algorithm in Critical Listening Rooms"* described our first commercial SoundWare program called the Room Optimizer™, which optimally locates multiple loudspeakers and listeners in critical listening rooms and home theaters. *"Fractal Sound Diffusors"* described the Fractal Optimizer™, which uses the same fractal generators that are used to create animation. Fractal generators offer unlimited shape possibilities.

NEW PRODUCTS

Last year was an intense period of R&D at RPG. One of the exciting new products is our patent-pending SilentSteps™ acoustical seating risers for arenas. They were developed in collaboration with WJHW, Dallas, TX to help absorb excess low frequency energy in arenas, by incorporating modified Helmholtz resonators in the seating risers. SilentSteps™ are now being evaluated for several arenas around the world. RPG works together with the project architect, acoustician and structural engineer to design a suitable riser system for each arena. SilentSteps™ are then fabricated by the approved pre-caster, under license by RPG.

PROJECTS

LINCOLN CENTER, NEW YORK

The Vivian Beaumont Theater is the first US installation of SIAP. The theater now offers excellent intelligibility, as well as active variable acoustics. Architectural Acoustics were by Jaffe Holden & Scarbrough, Norwalk, CT and the system installation was by ProMix, New York, NY.

HUMMINGBIRD CENTRE, TORONTO

This is the first project to utilize our Shape Optimizer™. The specifications were defined by the design team of Aercoustics Engineering Ltd., Theater Consulting Group Ltd. and Neil Muncy Associates. The theater now offers significantly improved passive and active acoustics.

CORNING VISITOR CENTER, NEW YORK

A fully-rigged VAMPS™ stage shell was specified by Shen Milsom and Wilke, New York, NY

NEWCASTLE ARENA, UK

This new arena has been widely praised for its acoustics and includes the first DiffusorBlox® installation in Europe.

Research & Development

CONCAVE OPTIMIZATION

In the last issue we introduced a powerful new surface optimization capability, which optimally shapes surfaces to provide the desired scattering. RPG is presently using this technology to develop a new generation of optimized surfaces, as well as collaborating with acousticians worldwide to design custom surfaces for specific applications. To help explain the power of this new approach, we will describe a case study prompted by a request from an acoustical consulting firm. The architect requested a concave surface in the rear of a recital/rehearsal hall, because of existing site restrictions and aesthetics. Concave surfaces have plagued acousticians for centuries and so it seemed like an ideal challenge for the new technique. To minimize the focusing effects associated with a concave surface, we selected the amplitude modulation feature of the Shape Optimizer™. This feature is useful when optimization is desired, while maintaining the general features of the requested surface.

OPTIMIZATION PARAMETERS

To optimize this concave arc profile, we require the desired width and depth, scattering coverage, depth modulation percent (we used 30%), number of harmonics, and source and receiver locations. 2D surface optimization will be the subject of a future discussion. The program generates a surface shape from the specified set of sinusoidal harmonics, which are then used to amplitude modulate the concave arc. The optimized surface may be constrained to only include concave sections whose focal point is less than the closest receiver positions. However, ray tracing and Boundary Element Method (BEM) analysis indicate that this is a minor issue. In Figure 1 we illustrate the original concave surface and the amplitude modulated optimized profile. In this example, sources and receivers were placed between 2 and 6 m from the surface and scattered between ±80°. The concave arc has a radius of about 2.3 m so sources at that location focus straight back onto themselves. Before and after optimization we must evaluate the performance using a full BEM analysis. To describe the concave surface before optimization, we place a source at 2.3 m and evaluate the scattered pressure on a receiver arc of radius 2.3 m. In Figures 2 and 3, the focusing from the concave arc is apparent by the concentrated energy at 90° (dotted lines).

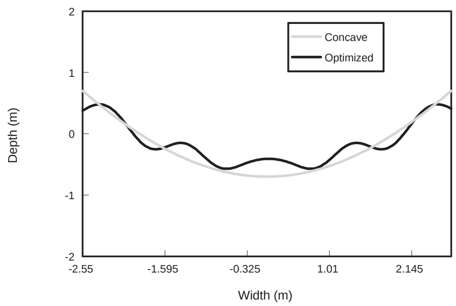


Figure 1. Comparison between the original concave surface and the amplitude modulated optimized profile.

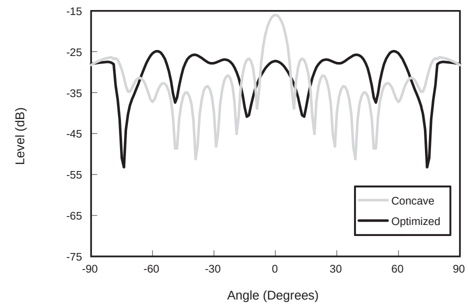


Figure 2. Comparison between the 500 Hz angular response of the original concave surfaced and the optimized profile.

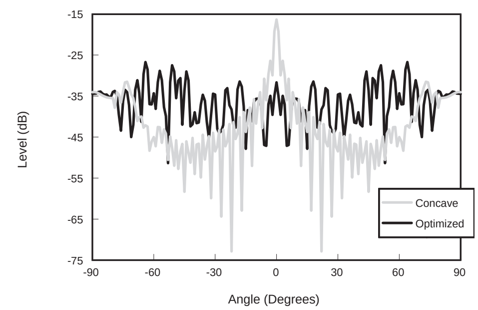


Figure 3. Comparison between the 2 KHz angular response of the original concave surface and the optimized profile.

RESULTS

After the optimization has converged to an acceptable solution, the optimized surface is evaluated as before using a BEM analysis. In Figures 2 and 3, we compare the pressures on a 2.4 m arc from a source at 2.3 m for 500 Hz and 2 KHz, respectively. It can be seen in the solid lines that the focusing present with the concave surface has been minimized. Ideal diffusion in this case would be a flat horizontal line. It can be seen that the optimized profile provides excellent uniform coverage. In Figure 4 we illustrate what the optimized surface would look like.

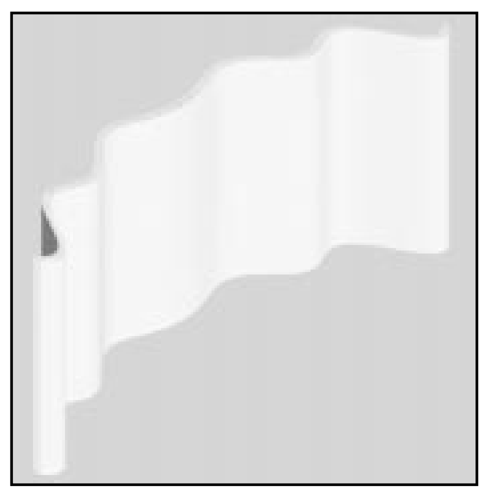


Figure 4. Rendering of the optimized surface.

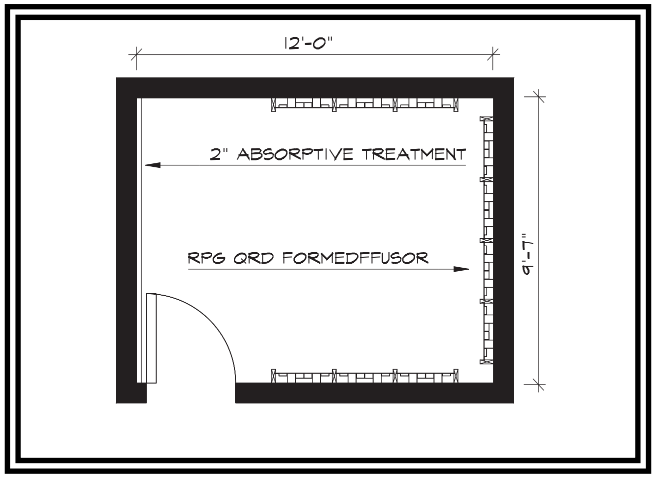
MUSIC PRACTICE ROOM

Small room acoustics often pose a greater challenge to the acoustical consultant than larger spaces. The music practice room is a good example of this, because this type of space must be able to accommodate a wide range of instruments and musical styles.

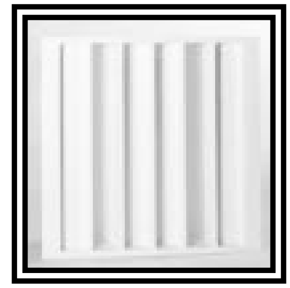
Ideally these rooms would provide similar acoustics to those encountered on stage when the musician is playing along with the ensemble. Due to budget constraints these rooms often do not receive the same level of treatment as the larger performance and rehearsal spaces. This is a shame in that the majority of time that a musician spends rehearsing his music, is spent in these spaces. The drawings to the right represent one way to help simulate the acoustical environment that a performer might experience during a live performance.

QRD® Formedffusors are used on the rear and two side walls surrounding the musician. Since the reflective boundaries are typically located a greater distance from the performer while on stage, the QRD®s help establish a more diffuse sound field that would be experienced by the musician during a live performance. FRG Omniffusors on the ceiling above also lend to the psychoacoustic impression of performing in a larger space. An absorptive front wall simulates the effect that one would experience when playing into a larger volume space. Much like a performer on stage playing into the audience chamber.

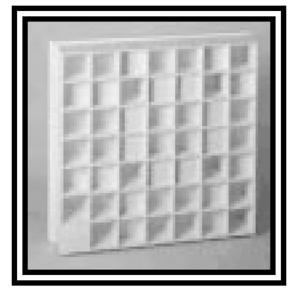
If you have experience using our products in a particular type of space, we would appreciate it if you shared your application with us. It could be featured in an upcoming issue.



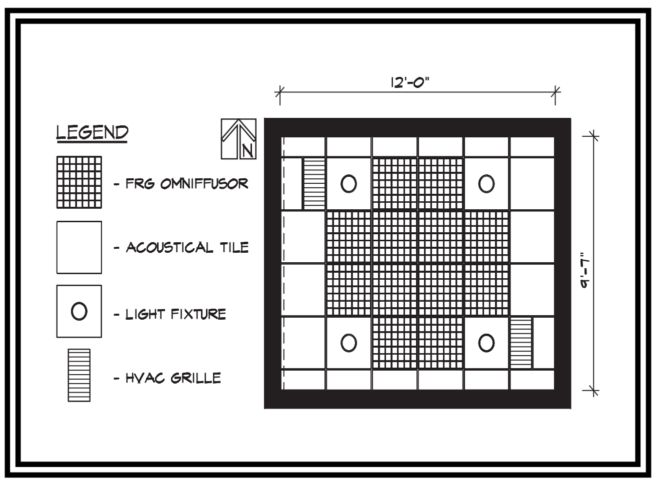
Plan view of Music a Practice Room



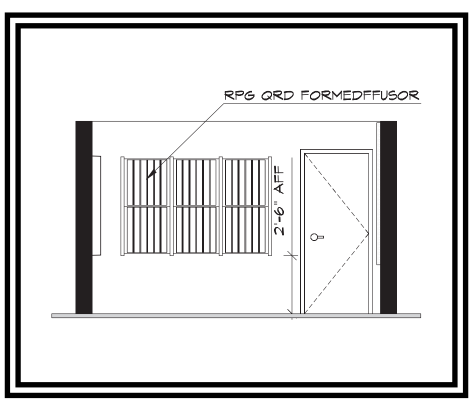
QRD® Formedffusor



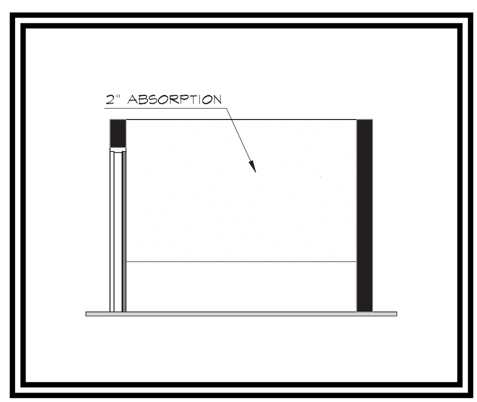
FRG Omniffusor™



Reflected Ceiling Plan of a Music Practice Room



South Wall Elevation



West Wall Elevation

Project Profile: International Music Camp

View from front of house

View from rear of house

Closeup of custom shell

ARCHITECT

"The International Peace Garden Consortium, a joint venture between Mutchler Bartram Architects, Fargo, ND and Gaboury Associates, Winnipeg, Manitoba, Canada, successfully used QRD® 734s and FRG Omniffusors™ to create a versatile orchestra shell. Flexibility is obtained by moving the QRD® panels toward the center of the stage to create a more intimate setting and the natural wood finish of the QRD® complements the rustic heavy timber style construction of the 500-seat performance hall." *-Brian Berg of Mutchler Bartram Architects.*

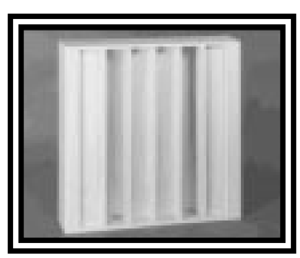
CONSULTANT

"We were presented with the task of designing an orchestra shell and performance acoustics for a multi-purpose, open A-frame structure. Additional requirements mandated that the shell be configured for a variety of performances, present a mien befitting it's international stature, and of course fit within the prescribed budget. RPG Diffusor Systems products enabled us to meet all of the requirements while providing the performers on stage and members of the audience with the appropriate acoustical environment." *-Ken Bilyk of Bilyk Technologies, Winnipeg, Manitoba, Canada.*

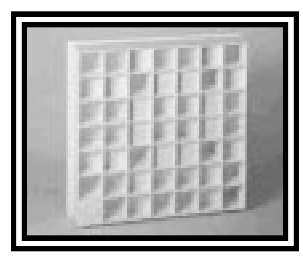
CLIENT

"The International Music Camp Center for the Performing Arts, located at the International Peace Garden, needed an acoustical treatment that would enrich both vocal and instrumental performance for a variety of ensemble sizes. The flexibility of the RPG product as well as the intricate acoustical design, has created an exciting and effective aural environment." *-Joe Almé of The International Music Camp, Minot, ND.*

PRODUCTS



QRD® 734



Omniffusor™

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