

THE RPG STORY: THREE DECADES OF INNOVATION 1983



First Presentation at AES

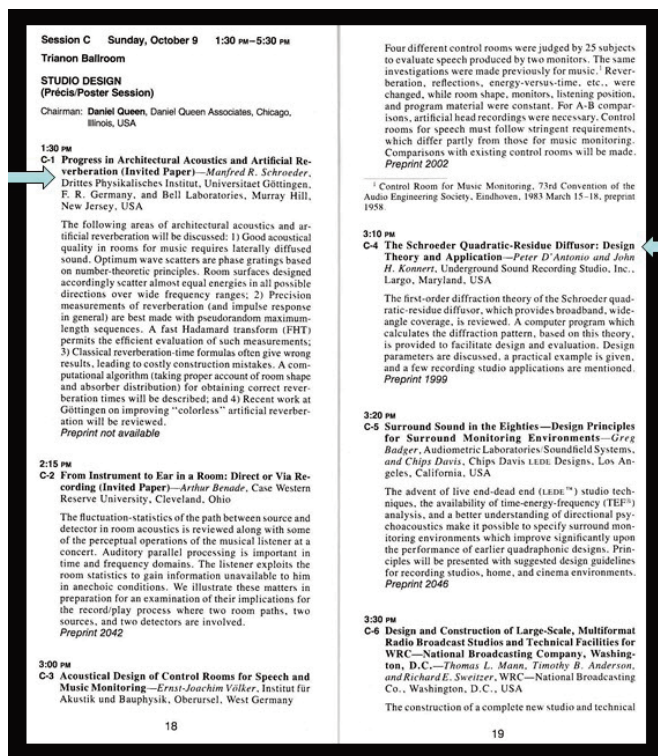


Figure 1. 74th AES Studio Design Session C

1983 was a very busy year for RPG. In October 1983, at the 74th AES Convention in New York, Dr. D'Antonio presented, Figure 2, his research on the Schroeder diffractor in the Studio Design Session C (C4 Arrow), with Manfred Schroeder presenting as the lead off invited speaker (C1 Arrow). The original Session C Program is shown in Figure 1. As part of this presentation, Dr. D'Antonio described an Apple II program, shown in Figure 3, which allowed acousticians to design these phase gratings as well as plot their diffraction patterns. Following the session, Manfred and Peter had their first personal meeting where Manfred described the use of the Chinese Remainder Theorem, which enabled the creation of a two-dimensional primitive root sequence from a longer 1-dimensional sequence, maintaining the beneficial Fourier property of a flat power spectrum. In Figure 4, we show the original handwritten notes in the 74th Technical Meeting & Professional Exhibits AES Program Oct. 8-12, 1983, illustrating the diagonal filling process, making use of periodicity, for several primes, N , for which $N-1$ could be factored into two relative co-primes, i.e. it cannot be used for $N=5$. ■■■■



Figure 2. Dr. D'Antonio's Speaker's Badge

8.2 PROGRAM QRD- EXAMPLE OUTPUT

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1 REM PROGRAM ORD
14 POK 33,40
15 POK 105,105; POK 106,78; POK 107,0; POK 108,96; POK 109,0; POK 110,76; REM MOVE NUMERIC STORAGE ABOVE HER PAGE 2.
20 GOTO 1000
30 REM FORMULATIONS OF REFLECTION FACTOR FOR NPL PERIODS
40 RS = 0.15 : OCTT = 0.2 : INTZ = NSD * NWL
60 FOR NZ= 0 TO NPL - 1:RS = RS + COS (NZ * S * TT) - 15 + SIM (NZ * S * TT); NEXT
140 FOR NZ = 1 TO NTZ
150 POK NZ = 1 TO NML:(AA = AA + COS (- 30(NZ)) * TM + S * FN X(1)(1)):BB = BB + SIM (- 30(NZ)) * TM + S * FN X(1)(1):II
11 : I : NEXT
180 IF NTZ = 0 THEN 220
200 FOR NZ = 1 TO NTC:AA = AA + COS (S * FN X(1)(1)):BB = BB + SIM (S * FN X(1)(1)):II = II + 1 : NEXT
220 NEXT :A2 = AA:R2 = BB:A4 = A2 + R2 : B2 = B2 + R2 : A2 = A2 : I2 : RETURN
1000 PRINT "QUADRATIC-RESIDUE DIFFUSION PROGRAM IN APPLESOFT"
1004 PRINT : PRINT "BY PETER D'ANTONIO, UNDERGROUND SOUND RECORDING STUDIO, LARGO, MO 20772." : PRINT : PRINT
1020 DIM D(101),A(101),B(101),P2(24)
1030 DEF FN X(I) = XI * I
1040 DEF FN AS(I) = ATN (X / DOB - (X + X + 1))
1060 DEF FN MOD(I) = INT (XI / NWL - INT (X / NWL)) * NWL + 0.001
1070 DEF FN AS(I) = (I - 3) * DA + AI
1080 DEF FN FP(X) = INT (X * P + .5) / P
1095 READ PIX:FOR I1 = 1 TO 0 PIX:READ PL(11):NEXT
1100 DATA 24,5,3,7,11,15,17,19,23,29,31,37,41,47,53,59,61,67,71,73,79,83,89,97,101
1125 READ VN,VH,W,H,P,D,TM,F1,N2,M,P1,P
1126 DATA 159,126,140,130,21,10,50,I,0.5,2.145927,13560,1000
1140 PRINT "TYPE DESIGN FREQUENCY IN HERTZ":PRINT FQCM = V / 180(FM : .75 + FQ:PRINT
1160 PRINT "ENTER WELL WALL WIDTH IN INCHES (TYPE 1)"
1180 PRINT "OR MAXIMUM FREQUENCY IN HERTZ (TYPE 2)":PRINT IDZ:PRINT
1200 IF IDZ = 1 THEN 1240
1210 IF IDZ = 2 THEN 1340
1220 PRINT : PRINT "INCORRECT INPUT TYPE 1 OR 2 ":PRINT CHN 17)
1222 GOTO 1160
1240 PRINT "TYPE WELL WIDTH IN INCHES":INPUT W
1260 PRINT "TYPE WELL WALL WIDTH IN INCHES":INPUT NWK:PRINT
1280 FI = V / (2.0 + (W + NWK))
1300 PRINT "DIFFUSION BANDWIDTH =":FN FP(FI):HZ TO = FN FP(FI):HZ
1320 GOTO 1480
1340 PRINT "TYPE MAXIMUM FREQUENCY IN HERTZ":INPUT FX
1350 PRINT "TYPE WELL WALL WIDTH IN INCHES":INPUT NWK
1360 W = V / (2.0 + FX) - NWK
1380 PRINT "WELL WIDTH =":FN FP(W):INCHES
1420 PRINT "DIFFUSION BANDWIDTH =":FN FP(FI):HZ TO = FN FP(FI):HZ
1440 NSL = INTZ - 0.25 : W / NSL
1450 IF W = 0 THEN 1500
1500 NTZ = :NSL * NTI + W / W + .3:DX = W / NSL:NWL = NTZ * DX
1540 PRINT : PRINT "ACTUAL WELL WALL WIDTH USED IN CALCULATION =":FN FP(WNW):INCHES
1560 PRINT : PRINT "NUMBER OF DEPTH SAMPLES PER WELL=INT$
1600 PRINT "NUMBER OF WELL WALL ZERO DEPTH SAMPLES=INT$
1620 PRINT "ENTER NUMBER OF WELLS PER PERIOD(TYP 1)"
1640 PRINT "OR NUMBER OF DIFFRACTION LOBS AT DESIGN FREQUENCY (TYPE 2)":INPUT IDZ:PRINT
1660 IF IDZ = 1 THEN 1700
1660 IF IDZ = 2 THEN 1760

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Figure 3. Construction illustrating constructive interference condition in which $BC-FG=m\lambda$.

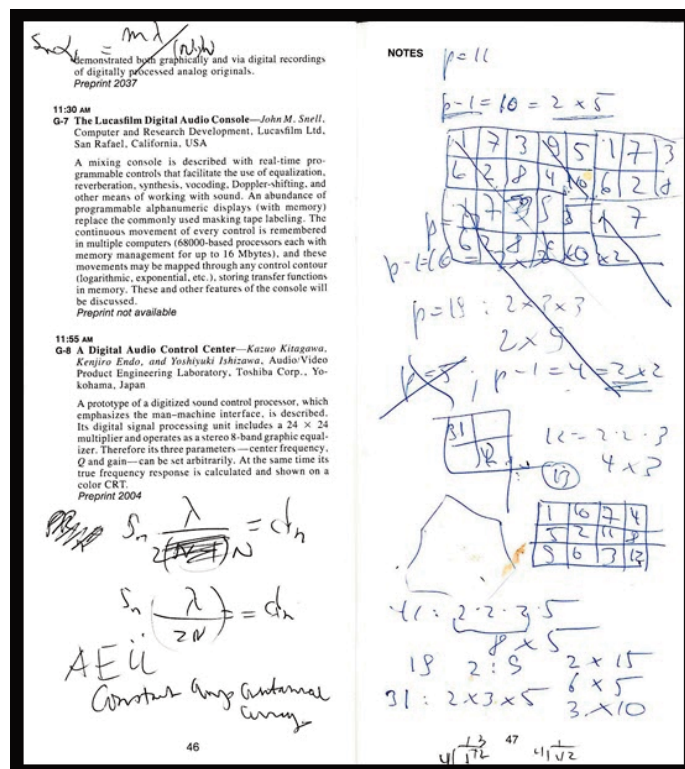


Figure 3. Handwritten notes by Manfred Schroeder illustrating the use of the Chinese Remainder Theorem.

First LEDE & Studio Design Workshop

At the AES meeting, Peter met Don and Carolyn Davis who invited him to present his research at the LEDE & Studio Design Workshop at Dallas Sound Labs, Figure 1. Don Eger of Techron along with the class made the first ETC measurements and listening tests of a QRD

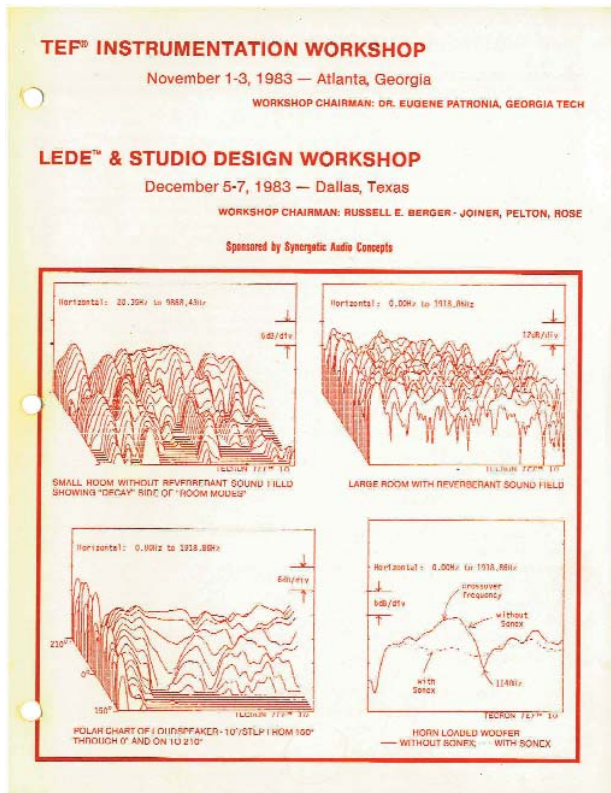


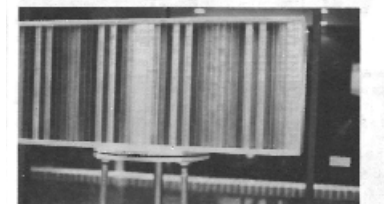
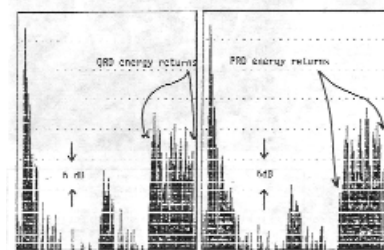
Figure 1. LEDE & Studio Design Workshop Announcement

and PRD in the Dallas Sound Lab control room, with the TEF-10 analyzer, Figure 2. The time response data clearly show the temporal distribution of the scattered-sound from the diffusors, compared to the specular reflection from a flat board placed in front of the diffusors. Photos of the first QRD and PRD are shown in Figure 3. With the outdoor diffuse lighting, the well depth sequences are illustrated by the shadows.

SCHROEDER'S QUADRATIC-RESIDUE DIFFUSOR

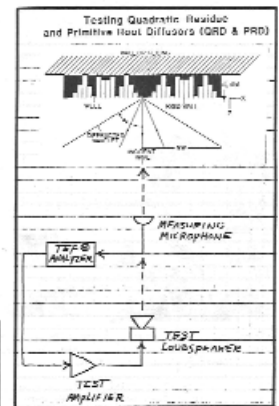
A paper of special interest to us was given at the 7th AES Convention in New York City this past fall entitled "The Schroeder Quadratic-Residue Diffusor: Design Theory and Application." The authors are Peter D'Antonio and John H. Kinnert. We were pleasantly surprised to learn that Dr. D'Antonio knew of our TEF-10 work and had built some of the Quadratic-Residue Diffusors for use in his own studio.

Russ Berger of Joiner-Pelton-Rose Consultants in Dallas was also fascinated with the paper and invited Peter D'Antonio to come to the special UIU class in Dallas and bring along a sample of his work. He did indeed and they were large boxes nearly 6 feet long and weighing 250 lbs. More important, they worked. Many of us felt, after hearing them perform, that we had never heard real diffusion before.



ABOVE: A QRD (left) and PRD (right) are visible in the pattern on our J. W. Davis turntable.

RIGHT: Peter D'Antonio standing next to one of his diffusors. These extraordinary devices are of a size reasonable to use in control rooms without having compromised the superiority inherent in the concept.



Bob Volkmann (left) and Bill Hahn talking with Russ Berger. Now in the back room of the D'Antonio diffusors in the control room he is building for the Oak Ridge Boys.



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Figure 2. First TEF measurements of the time response for a QRD and PRD.

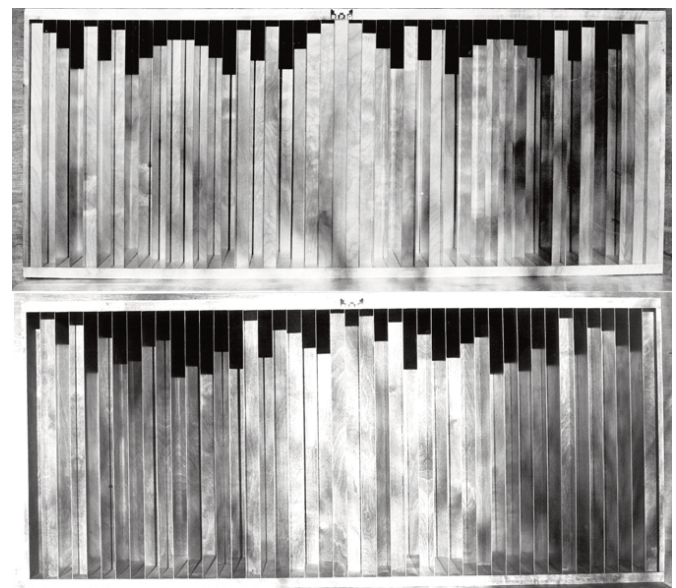


Figure 3. Top: First QRD based on a prime of 23; Bottom: First PRD based on a prime of 23. Shadow patterns illustrate the well depth sequences.

First RPG Diffusor Fabrication Facility

RPG started out as a cottage industry in which manufacturing was set up in Dr. D'Antonio's residential carport/garage and backyard. RPG's original employees consisted of Dr. D'Antonio's son Peter, his neighborhood friends and some of their parents. Manufacturing was initially done in a carport, which was eventually enclosed as shown in the top photo of Figure 1. Due to limited space, manufacturing was also done in the back



Figure 1. RPG's 1st home grown indoor and outdoor fabrication facility, with original employees Kathy Koenig and Doug Morgan. .

yard, weather permitting, as shown in the bottom photo of Figure 1. In Figure 2, Doug Morgan and Peter await the arrival of the shipping truck and in Figure 3, they toast this first shipment with champagne. In Figure 4, the first shipment is shown. While it appeared strange to have shipping trucks arriving and departing from a residential street, all of the neighbors were supportive of the cottage industry. As RPG quickly grew, it became necessary to move to a commercial location.

On Dec. 15, 1983 Dr. Peter D'Antonio and Dr. John H. Konnert, a co-worker at the Naval Research Laboratory, incorporated RPG Diffusor Systems, Inc. with a mission to "Continually expand the acoustic palette with innovative acoustic tools, through a commitment to fundamental acoustics research." And the rest is history! 🎉



Figure 2. Doug Morgan and Peter await the arrival of the shipping company.



Figure 3. A champagne toast to the first RPG diffusor shipment.



Figure 4. First shipment of an RPG Diffusor.

First RPG Diffusor Application

At the 74th AES Convention in New York, Peter also met Bob Todrank, President of Valley Audio in Nashville, TN who eventually would utilize the first commercial RPG Diffusors in the new control room of the Oak Ridge Boys, called Acorn Sound Recorders, in Hendersonville, TN. A photo of the Acorn Sound Recorders control room is shown in Figure 1, along with the Oak Ridge Boys. The studio was a major success and the word soon got out that the RPG Diffusor was a new required tool in modern control room design. ■■■■

'Come On In'

Valley Audio invites you inside ACORN SOUND RECORDERS' new control room.

When the Oak Ridge Boys wanted a new control room for their Acorn Sound Recorders in Hendersonville, Tn., they entrusted their chief engineer, Jimmy Tarbutton, with the responsibility of contracting the best services available for the job. He chose Bob Todrank and Valley Audio.

"I wanted the latest in control room technology with a large functional space. Since we were building from the ground up, it had to be right. I chose Bob to completely design the room and oversee the construction. I wanted Valley Audio's technical services to do our equipment interface because of their more than ten years' experience in audio installations, and selected the new Harrison MR-4 32-24 console based on its flexibility and innovative design. We then selected a long term associate, Jim Aanderud of Viking Enterprises as our contractor."



The Oak Ridge Boys



Rear wall showing diffusion/reflection

Todrank says, "Since Jimmy wanted a large, open room with a very 'live' feel, I designed a control room incorporating the latest *LEDE (Live End/Dead End) concepts. I chose a rear wall diffuser system designed by Peter D'Antonio of RPG Diffusor Systems, Inc., to accomplish a widely dispersed sound field around the console. We built and installed the very first of its kind anywhere and I was thrilled with the results. I also used our TECRON TEF equipment to place the final room interior treatments. The proper implementation of the LEDE design theory along with the use of on-axis monitoring, correct room geometry and accoustical equalization (selective diffusion/reflection/absorption techniques) has resulted in a room I'm very proud of."

The Oaks are proud of it too. Duane Allen's reaction... "It's like a dream come true."

*LEDE is a registered trademark of Synergetic Audio Concepts.



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Figure 1. Acorn Sound Recorders, with the Oaks