AES Audio Engineering Society - Pacific Northwest Section

Around the Puget Sound, Seattle, Washington, U.S.A.

| AES HQ | ARCHIVE | ABOUT AES | LINKS | JOBS | EVENTS |

[Printer-friendly version](#)

NEW! [What's New?](#)

Click [here](#) for a one-page version of the meeting notice, suitable for posting.

From Hear to Eternity

Sampling, Conversion and The Limits of Hearing

A Seminar With

James Johnston

Dr. Melissa Harrison

Dr. Richard Cabot

Steven Green

Bob Moses

Steve Macatee

Moderated by Dan Mortensen

Co-sponsored by

AES PNW Section

and

Center for Digital Arts and Experimental Media at the University of Washington

Saturday, February 7, 2004, 9:30am-5pm.

ADVANCE REGISTRATION REQUIRED

(see below)

Join us in an all-day journey into the intricacies of sampling audio for conversion into digital data. Our intention is to present the subject in as much depth as possible, with the time and resources available; we will be together for an entire day with a formidable array of experts on various aspects of the subject who will freely share their knowledge with us.

We'll examine in substantial detail

- the advantages and disadvantages of different sampling rates
- problems and artifacts resulting from the conversion transformation
- methods of solving those problems and minimizing those artifacts
- the mathematical underpinnings of sampling and conversion
- the physiological and psychological limits of the hearing process so that we can understand the resolution capabilities of the human system

There will be as many listening examples as we think appropriate, and there is the possibility of small-group discussions about particularly esoteric sub-topics.

To prepare yourself for what promises to be a significant download of information, we have prepared some Internet links to background reading on various aspects of the subject.

The Program (subject to change)

9:30am Seminar begins with Introductions

James D. Johnston will discuss some very basic facets of how the human ear works, some basic physics of the atmosphere as it relates to human hearing, and explain what kinds of artifacts are or may be audible in conceptual terms. He will relate these basic facts of human audition and acoustics to the basic demands put forth on digital audio convertors. 45 min- 1hr. plus questions

Dr. Melissa Harrison will introduce us to Fourier Analysis and the Basics of Analog to Digital Conversion
Abstract: Fourier Analysis is a powerful tool for understanding many aspects of analog to digital conversion. Time-frequency duality ideas are used with pictures and examples to illuminate issues related to sampling, oversampling, and aliasing. Other topics such as decimation, jitter, quantization, dithering & noise shaping are briefly introduced. 45 min- 1 hr. plus questions

Lunch (BYO Brown Bag, or go to nearby food vendors) 1 hr. Beverages provided.

noonish **N.B. Alcohol is not allowed in the building, so if you need to wash your lunch down with a fermented beverage you'll need to go off-campus to one of many nearby eateries.**

1-ish Dr. Richard Cabot and Steven Green will, in separate presentations (exact division TBD):

- What goes wrong in the real world, and common solutions
- Audio sampling: Aliasing, Quantization error, Dither, Jitter, noise shaping
- Basic Filtering and other applicable signal processing
- Types of converters
- Successive Approximation, Delta-Sigma, multi-bit
- Current Off The Shelf Parts (Vendors, Specific Parts)
- And more.

Following the individual presentations, we'll have panel discussions on the following subjects:

- Why support higher and higher sample rates? Or should we as an industry? Is this all just marketing?
- If the majority of sold audio recordings are 44.1/16 or 24-bit [CDs & DVD movies] (many of which get converted to MP3) why do audio and chip manufacturers continue moving into higher rates for certain products and applications?
- What percentage of the market do SACD and high res DVD-A discs make up?
- Pros / cons of sampling above 44.1 kHz
- Pros / cons of part choices
- Tweaks for off the shelf parts
- Dither, Noise shaping
- The audio device manufacturer's perspective

- Why do different converters sound different?
- Is there a "pleasing" sound that is different than "accurate"?
- If the parts are off the shelf, what makes up the differing cost of different units?
- What factors other than the converters themselves affect the sound of any device?
- Theoretical (how it's supposed to work, but here's the problem.
- Audience Questions

5pm   Seminar End

Presenters and Demonstrators

Presenters

- **James D. Johnston, Microsoft Corporation**
  Mr. James D. Johnston received the BSEE and MSEE degrees from Carnegie-Mellon University, Pittsburgh, PA in 1975 and 1976, respectively.

  Mr. Johnston temporarily retired in 2002 but worked 26 years for AT&T Bell Labs and its successor AT&T Labs Research. He was one of the first investigators in the field of perceptual audio coding, one of the inventors and standardizers of MPEG 1/2 Audio Layer 3 and MPEG-2 AAC, as well as the AT&T Bell Labs or AT&T Labs-Research PXFM (perceptual transform coding) and PAC (perceptual audio coding) and the ASPEC algorithm that provided the best audio quality in the MPEG-1 audio tests.

  Most recently, he has been working in the area of auditory perception of soundfields, ways to capture soundfield cues and represent them, and ways to expand the limited sense of realism available in standard audio playback for both captured and synthetic performances. He is currently employed by Microsoft.

  Mr. Johnston is an IEEE Fellow, an AES Fellow, a NJ Inventor of the Year, an AT&T Technical Medalist and Standards Awardee, and a co-recipient of the IEEE Donald Fink Paper Award.

- **Dr. Melissa Harrison, Ph.D.**
  Dr. Melissa Harrison is an independent technical consultant. She has a PhD in applied mathematics from the University of Maryland and is interested in signal processing, particulary for audio signals.

  Dr. Harrison has worked in various areas of computing and mathematics for over 20 years, including Fourier analysis, irregular sampling of bandlimited signals, robotic vision & route planning, optical holography, switched-circuit network provisioning, mathematical and scientific programming, system administration, and technical typesetting. She has over 10 years experience teaching mathematics at the university level.

- **Dr. Richard Cabot, XFRM, Inc.**
  Dr. Richard C. Cabot received 4 degrees, including a PhD from Rensselaer Polytechnic Institute and an MBA from Pepperdine University. After 6 years in engineering at Tektronix, he was a co-founder and the CTO of Audio Precision. He designed the System One analog generator and

the digital sections of all the products until selling the company in 2000. His current firm, XFRM, Inc. (pronounced "transform ink") does research and consulting in digital audio technology. They can be found on the web at www.xfrm.com. He has held several positions in the AES, including President, and has presented numerous papers on audio technology both to AES conventions and conferences as well as to other organizations.

- **Steven Green, Cirrus Logic**
  Steve Green has over 25 years experience in the audio business including nearly 13 years with Crystal Semiconductor / Cirrus Logic as an Applications/Technical Marketing Engineer. In this role Steve has had the privilege of working with many of the leading mixed-signal IC and audio hardware design engineers from around the world. Steve has also authored several papers for the AES, multiple Crystal Applications Notes, magazine articles and is a co-author of the 1995/1996 Crystal Semiconductor "World Tour" Applications Seminar. Prior to Crystal/Cirrus, Steve worked as a design engineer for White Instruments.

Demonstrators

- **Bob Moses, Island Digital Media Group, LLC**
  Bob Moses has been sabotaging perfectly good audio by converting it into the digital domain since the early 1980s. He spent 8 years designing digital products at Rane before leaving a perfectly good job to cofound PAVO and Digital Harmony in 1995. After the market crashed, taking PAVO and DHT with it, he went to work in his garage on Vashon Island as a consultant, working for a variety of pro and consumer AV companies including: JBL, Microsoft, Audio Precision, Intel, Alesis, BridgeCo, AKM, Dolby, Harman Consumer Group, Meridian, M-Audio, and others. Bob is also serving a second term as AES Vice President of the Western USA/Canada region, and is the chairman of tutorial sessions for the upcoming 117th AES Convention next fall. His mom is especially proud that he won the Life Member Award from the IEEE about 20 years ago (for work he did on Oversampling for CD Players), but he lost the plaque so he's just a normal guy again.

- **Stephen Macatee, Rane Corporation**
  Steve Macatee was born very young in Philadelphia. Then in 1986 he received a BS in Electronic Engineering from Monmouth College, New Jersey, USA. This is not too far from the armpit of the world, Elizabeth, NJ   but believe it or not, there is a valid reason New Jersey is called "The Garden State."

  Steve has worked at Rane Corporation since 1987 in several capacities: from manufacturing; mechanical, interface & PCB design; in-house & product documentation; analog, digital, embedded systems and   luckily for everyone   not much GUI or DSP software design. After a decade in R&D Engineering, Steve underwent an Inverse Dilbert Transform and moved to Sales for 4 years as a technical and consultant/contractor liaison. He currently heads the New Product Development and Training department at Rane where he works to define new product & technology ideas.

  Steve has been an instructor for audio workshops on Grounding and Audio Networking, has published papers on grounding and computer-controlled networked audio systems and enjoys getting out of the idealized lab and into the real world.

  For fun, Steve enjoys music, great food, spending time with his most-excellent wife and

attempting to be a musician with several jazz ensembles in the Seattle area. But, being a drummer, perhaps "musician" is not the proper word?

Moderated by Dan Mortensen, Dansound Inc.

ADVANCE REGISTRATION: In order to stay within room capacity, regi

stration"); is required. Send your name, affiliation (if any), preferred email address, and telephone number with your request for registration. The facility can accomodate over 100 participants. Registration is strictly first-come-first-served. After you register, you will receive an email with the exact location on the UW campus.

COST: There is no cost for the program. Non-members of the AES are welcome.

MEALS: We will break for a no-host lunch (meaning BYOL). You can eat onsite or go to one of numerous eateries in the U-district. Beverages will be provided.

N.B: Be sure to revisit this site in the coming week as changes will likely occur as the final details of the program are finalized.

Our meetings are open to anyone interested in Audio. AES membership is NOT required for you to attend our meetings.

Dave Tosti Lane

AES PNW 2003-2004 Section Chair

---

e Se

ction Chair"); e webmaster"); iling list"); e Section Secretary");

[Section Officers Contact List](#) [Mission Statement & FAQ](#) [Past Meeting Recaps](#) [Job Postings](#)
[List-o-Links](#) [Current and Coming Events](#) [About](#)

- **This is a cookie-free site.**
- **No data collection.**
- **No PopUps!**
- **No funny business.**

Last modified 1/31/2004.

References List

The References listed below were not necessarily used to prepare the material for, and are not required to attend this seminar. They are provided to give the attendees an opportunity to familiarize themselves with the topics that will be presented. We make no claims as to the accuracy of the information presented in these references. YMMV!

Cirrus Logic

[ABCs of DACs](#)
[Converter Technologies Boost Audio](#)
[AES White Paper](#)
[Additional White papers from Cirrus](#)

Web References for A/D

[Sampling](#)
[More on Sampling](#)

Julian Dunn paper on ["Anti-alias and anti-image filtering: The benefits of 96kHz sampling rate formats for those who cannot hear above 20kHz."](#)
[Encyclopedia discussion of A/D conversion](#)

Chip Manufacturers

The following companies manufacture A/D and D/A converter chips. Some of them may have application notes or white papers, and their sites will also have data sheets for the parts that they make and sell.

[AKM Corporation](#)
[Analog Devices](#)
[Texas Instruments](#)
[Cirrus Logic](#)

Jim Johnston

Two previous presentations by Jim Johnston:

http://www.ece.rochester.edu/~gsharma/SPS_Rochester/presentations/audio2003.pdf

http://www.ece.rochester.edu/~gsharma/SPS_Rochester/presentations/JohnstonPerceptualAudioCoding.pdf

Other stuff

Examples of audio spectrum analysis:
http://www.visualizationsoftware.com/gram/examples.html This is a very cool site with short time fourier transforms of different sounds (with audio!)

Fourier Synthesis:
http://www.phy.ntnu.edu.tw/java/sound/sound.html A fun java applet for seeing how the Fourier series takes a signal apart into sinusoids of different frequency

Digital Representation of Sound:
http://x.i-dat.org/~csem/UNESCO/1/1.pdf A pdf file giving a short introduction to digitization of audio signals.

Last modified 1/25/2004.