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AES Audio Engineering Society - Pacific Northwest Section

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

NOTE: anyone can attend this meeting regardless of their status as an AES member.

AES MEMBERSHIP IS NOT REQUIRED.

**Impedance...
Because Resistance is Futile!
Presented by
Steve Macatee, Dennis Noson,
Colin Isler, Dana Olson, & Mark Rogers
and
The Pacific Northwest Section of the AES
Monday, March 20th 2017, 7:30pm
Opus 4 Studios, Bothell WA**

[Directions to Opus 4 Studios](#)

Impedance [im-peed-ns]

impedance: the complex combination of DC resistance and frequency dependent reactance in an AC circuit.

reactance: the non-resistive component of impedance in an AC circuit, arising from the effect of inductance or capacitance or both and causing the resulting current to be out of phase with the electromotive force causing it.

If that second definition appears bewildering, our presenters will offer enlightenment.

Two further (and more detailed) definitions can be found by clicking [here](#).

Bob Smith:

(PNW Section Committee, Physio Control, BS Studios)

The topic of impedance comes up in many audio-related discussions and it's safe to say that unless you are an EE, there is a high degree of misunderstanding of this important topic, something worthy of more than just tribal knowledge.

Early on you're told to match impedances; i.e., the source impedance and load impedance must be equal. It seems easy enough to grasp. Then suddenly you're told that the load impedance needs to bridge the source impedance. What's with that? With video and RF, you find that impedance matching does matter... and even the cable has an impedance parameter. If your

brain hasn't locked up yet, there is the matter of *acoustical impedance*.

It's all enough to give you impedance on the brain!

To match or not to match... That is Z question!

Our March meeting covers Impedance in both the acoustic and audio (electrical) contexts.

- Steve Macatee will provide a brief introduction and definition to set the stage for the four main presenters.
- Dennis Noson will extend the definition of impedance – a dynamic (vs. static) parameter of pressure waves in the air – to explore how this concept helps in understanding audio system speakers, singer's voices, and acoustic instruments. Using beautiful slides, colorful graphs, and bit of handwaving, the dynamism of radiated sound will be revealed, whether transduced by audio or radiated by tubes and plates – from organ pipes and piano soundboards (not *that* soundboard), right up to Amar Bose's presumably ideal one-eighth of a pulsing sphere.
- Colin Isler from Rane will cover the Impedance of Audio Interfaces.
- Our own Dana Olson will show some plots of impedance curves — perhaps even measure one actively live to show the process and to hear it sweep. Then he'll talk about what these curves mean, how they are used and what effect a 4 ohm vs 8 ohm speaker has on amplifier performance.
- Mark Rogers will point out the pitfalls in the wiring of distributed speakers, whether wired in series or in parallel or in 25/70 V systems. Problems can manifest themselves not only as large losses, but also as frequency response anomalies that will be different at each speaker.

Our Presenters

Steve Macatee was born very young in Philadelphia. In 1986 he received a BS in Electronic Engineering from Monmouth College, New Jersey, USA. Steve worked at Rane Corporation in several capacities from 1987 until 2016. 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. For his last 15 years, he headed the New Product Development and Training department where he defined new products & technology ideas. Steve's joyride at Rane stopped when the owners sold the company in order to retire.

Steve has been an instructor for audio workshops for AES and SynAudCon on Grounding and Audio Networking, has published AES papers on grounding and networked audio devices and currently – along with Brad Benn – co-instructs the Synergetic Audio Concepts Digital seminars with Pat Brown of SynAudCon fame.

Dennis Noson Ph.D. is a professional acoustical consultant with 40 years experience investigating the acoustical behavior of sound in the human environment – encompassing a wide range of projects, from design of auditoriums and performing arts projects, to the control of vibration in medical facilities, improving noisy workplaces, and reducing the impact of noise

from increased flights at airports and higher traffic volumes on highways. He has contributed publications and presented talks at conferences and design seminars, with a focus on the auditory perceptions of performers and audiences in facilities housing vocal ensembles and orchestras.

Dr. Noson's work – both as a design consultant and as a scientific investigator – has contributed to an understanding of the varied contexts for hearing the human voice in its natural surroundings, paying close attention to how a singer or actor can convey a persuasive image of the spoken and sung voice, in order to best communicate his or her own sense of artistic "character" or persona.

Colin Isler A lifelong musician and tinkerer, Colin grew up playing cello and guitar and fumbling around with TVs and computers in the wooded Seattle suburb of Lake Forest Park. After studying electrical engineering and signal processing at the University of Michigan, he returned home to Seattle and began working for Rane Corporation, first as a manufacturing test engineer and later as an R&D engineer. Twelve years later, he continues to design Rane products at the Mukilteo office of InMusic Brands while writing, performing and recording music with a variety of local musicians. Occasionally you'll hear him singing and paddling his way around the waterways of the Pacific Northwest in his Easy Rider sea kayak.

Dana Olson was raised in Shoreline, and resides in Kirkland WA. He earned BS and MS degrees in Aeronautic and Astronautic Engineering from the U of W. He spent 9 years at Boeing as a control system engineer, developing control system design software, wind shear detectors, and fly-by-wire simulation for the 777. He spent 12 Years at Physio Control, developing DSP firmware and doing electrical engineering for heart monitoring, and spent 6 years at Cypress Semiconductor, developing capacitance touch screen-sensing and noise rejection systems.

Dana is an AES Member and a local Section Committee member. He's semi-retired, and learning to design loudspeakers as Olson Systems, LLC. On occasion Dana runs the sound board at Inglewood Presbyterian Church.

Mark Rogers, PE is Director of the AV Department at the Greenbusch Group, a Seattle engineering consulting firm. Recently retired, sort of. He is a designer of audio/visual systems, including sound reinforcement, audio reproduction, video projection and displays, videoconferencing and audioconferencing, and related control systems. Typical projects include corporate boardrooms, convention centers, universities and hospitals. He has been designing and installing AV for over 45 years, and also teaches classes and seminars on AV technology. He is a registered Professional Engineer (Washington and Idaho) and earned his BSEE at the University of Idaho. He is a past Vice Chair and Committee member of the PNW AES Section and has presented several topics to the Section.

Dan Mortensen

AES PNW 2016-2017 Section Chair

n.b. *The material presented at our meetings is the opinion of the presenter and not necessarily that of the Society. You are encouraged to conduct your own research and to form your own opinions before adopting the presented material as Truth.*

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

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