AES SWISS SECTION NEWSLETTER

135th Issue

INFORMATION ON NEXT MEETING

Low frequency mode control using active subwoofers

Thursday, the 3rd of September 2015, 17h00 at Relec SA Premises
ZI Petits Champs 11 (a+b) - 1400 Yverdon

SPEAKERS: Antoine Pittet - David Strobino (HEPIA)
Dr Hervé Lissek - Etienne Rivet (EPFL)
Alain Roux - Roger Roschnik (Relec SA)
Dr Véronique Adam (Goldmund / AudioNetworks SA)

ORAGNIZER: Véronique Adam

LANGUAGE: French or English

Schedule

17:00 - doors open and refreshments
(optional visit of Relec assembly shop)
17:30 - introduction (CTI project)
17:40 - low frequency resonance issues
18:00 - presentation of the low frequency absorption by velocity control through acoustic resistance
18:30 - presentation of the low frequency absorption by hybrid sensor-/shunt-based impedance control
19:00 - prototype demonstrations
20:00 - optional dinner

Please subscribe as usual at the web address: www.swissaes.org (under programme).

You're invited to continue the discussion in a nearby restaurant. Please sign-in before **August 31** for meeting and optional dinner (at your own expenses).

Summary

All premises used for sound measurement, recording, processing and diffusion, such as recording or post production studios, concert halls, sound laboratories, home theaters and listening rooms need to be acoustically treated to obtain the adequate reverberation and echo that is required by for their use. In a standard sized room, the natural standing resonances occur in general at low frequency and therefore represent a serious problem to be dealt with.

Several passives attempts to solve this problem have been made but they all have many limitations, in particular:

- the important size of the passive porous absorbers (thicknesses increases with the wave length: as an example, a minimum of 1 m of material is necessary to suitably absorb frequencies of 100 Hz).
- the limited bandwidth of the resonator systems, e.g. Helmholtz, membrane resonator, etc.

In the framework of a CTI project, four partners (two engineering schools and two audio companies) decided to develop subwoofers able to act as sound absorbers. The results of this project lead to an innovative equalization (in time and level) of rooms in the low frequency range. The project is now in the working prototype phase.

The development of two different technologies based on analog and digital control architectures has been undertaken:

Low frequency absorption by velocity control through acoustic resistance

Starting with the well-known porous layer in front of a wall, we first show the limitation of these systems. Then we demonstrate how this configuration can be significantly improved by using an acoustic velocity control behind the layer.

Finally we present an implementation using an acoustic resistance made of a micro-perforated metal sheet and a low frequency loudspeaker used as velocity transducer.

This system presents a very small footprint compared to other systems, is auto-adaptive and doesn't require any altering of the sound source.

Low frequency absorption by hybrid sensor-/shunt-based impedance control

Considering a loudspeaker diaphragm as a membrane absorber, loudspeaker systems can be designed so as to achieve desired acoustic impedance around the loudspeaker resonance frequency, typically around some tens of Hertz. This passive device can be upgraded to a hybrid impedance control architecture, combining a conventional microphone-based feedforward control with a current-driven electrodynamic loudspeaker system, to assign a desired velocity to the loudspeaker membrane.

Starting from acoustic specifications (eg. frequency-dependent acoustic impedance), a method to design such active control is given, and an experimental assessment in a waveguide of a prototype is presented. An application to the damping of resonances in a reverberant room using 4 prototypes is also presented. The performance in terms of room modal equalization is illustrated with several types of excitation: broadband noise, time-limited pure sine excitation at the different resonant frequencies, and music diffusion.

Biographies:

Antoine Pittet: He holds a Master degree in Physics from the Swiss Federal Institute of Technology in Lausanne (EPFL). From 1991 he is the responsible of the Acoustics Laboratory at the HEPIA (Geneva Engineer School).

David Strobino: He holds a Master degree in Microengineering from the HES-SO (University of Applied Sciences - Western Switzerland). He is a research assistant at the HEPIA Acoustics Laboratory from 2012.

Dr Hervé Lissek: He received a PhD in 2002 from the Université du Maine (Le Mans, France) for his work on « Matériaux actifs à propriétés acoustiques variables ». After a 3 years post-doc position at EPFL under the supervision of Prof. Mario Rossi, Dr. Lissek took the responsibility of the Acoustic Group of the Laboratory of Electromagneitcs and Acoustics at EPFL in 2006. His main research topics are Active Noise Control, Acoustic Metamaterials, Microphone Arrays Signal Processing and 3D Audio. Since 2015, he is affiliated with the Signal Processing Laboratory.

Etienne Rivet: He received the engineer's degree M.Sc. in Electronics, Telecommunications and Computer Science at Ecole Supérieure de Chimie Physique Electronique de Lyon, France. In september 2012 he enrolled in PhD studies at the doctoral school of Electrical Engineering (EDEE) of the EPFL. His main research is the development of electroacoustic absorbers for applications of low-frequency absorption / modal equalization in cavities.

Roger Roschnik: He holds a Bachelor Degree in Mechanical Engineering from the HEI-VD as well as a MBA from BSL Lausanne. He started his career in engineering consultancy before spending 12 years in a leading multinational company. He then started several industrial companies in Switzerland and abroad as well as working as and independent consultant in various fields. He is CEO of Relec SA, manufacturer of PSI Audio, since 2014.

Alain Roux: In 1975, whilst Studying at the EPFL in Lausanne, Alain Roux started producing his first speakers under the PSI brand. Two years later

he started the company that is now Relec SA. Over the past 40 years, Alain and his team have developed a huge variety of speakers for Hi-Fi, PA and Professional Studio applications under the brand name PSI Audio as well as OEM. Many of these products have won the industry's most desirable awards and equipped some of the most prestigious users around the world.

Dr Veronique Adam: She received in 1995 a Master degree in Microtechnical Engineering from the Swiss Federal Institute of Technology in Lausanne (EPFL). She received in 2003 a PhD degree from the EPFL for the thesis work entitled: "Loudspeaker Behaviour under Incident Sound Field". She works as a R&D project manager at Goldmund from 2003.

The AES Swiss Section would like to thank warmly Roger Roschnik and the Relec team for their kind collaboration in the organization of the meeting.

We look forward to welcoming you on the 3rd of September!

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REPORT ON PREVIOUS MEETING

High Definition Audio and New Trends in Live Sound

12th of June 2015, Lugano

SPEAKERS: Claude Cellier - Merging Technologies
Luca Giannerini - Live Sound Engineer
Giacomo De Caterini - Accademia di Santa Cecilia, Rome

REPORTER: Terry Nelson

It was with great pleasure that the AES Swiss Section organized its first meeting in the Tessin on the 13th of June. Warm thanks are to Patrick Greppi for organising this event.

The meeting drew over 40 members from both the Tessin and Italy and was held at the Grott Hard Café, just outside Lugano. We also had the pleasure of Leo Leoni, the founding member of Gotthard (and who also runs the café/restaurant!)

Patrick Greppi opened up the meeting with a brief overview of the basic principles of acoustics and the history of sound reinforcement techniques up to the present day – from the first valve (tube)-based equipment to present-day digital. He concluded by pointing out that a good 'workman' needs to understand his tools and how to best use them for optimum results.

The first speaker was **Claude Cellier** of Merging Technologies, who outlined the fundamentals of DXD technology and how it came about. Whereas digital may be considered convenient, it is only now that the audio quality can be the equal of analogue. This was very ably demonstrated by a series of response graphs and, in particular, the curves of an impulse response treated in the analogue and digital domains. It was edifying that the DXD response was the only one to virtually mirror-image that of analogue.

Giacomo De Caterini is a recording and live sound engineer from Rome has felt that music has always been speaking to us – we just weren't listening well enough! Though 'HD digital' can give good results, the new SACD (or DSD) and DXD technologies move the response into the 'Ultra' domain and offer improved micro-dynamics, a sense of clarity in the upper registers and an extended frequency response.

As well as for studio projects, Mr. Caterini has been using a Merging Horus DXD system for live events, the mixing console being the Pyramix Virtual Console in the computer. This means that the signal path is analogue in from the stage to the Horus and analogue out to the amplifiers. Events include both classical and jazz concerts and the public – even critics! – have noticed a heightened sense of reality with the sound.

"Before, I heard the sound coming from the loudspeakers, now I hear it from the stage'.

This effect has also been commented on by musicians, who say they 'hear' their instruments for the first time.

For **Leo Leoni**, the date of the meeting marked the official release of Gotthard's new album, "Live & Bangin'", which was recorded using DXD technology. The band is very happy with the results and an excerpt was played.

Igor Fiorini has very much the same philosophy as Giacomo De Caterini and various concerts with virtuoso musicians have led to critical acclaim from the public and acceptance from the musicians. A chance meeting with engineer, **Luca Giannerini**, at a trade seminar led to the latter taking up the DXD banner and using it for live work – with the same success.

The meeting was concluded with the time-honoured 'apèro'; together with live music from the Italian duo, **Duepuntzero** - using DXD technology, of course!

The evening ended with a very social dinner at the Grott Hard Café.

The AES Swiss Section would like to thank the following sponsors who made possible this interesting event.

Leo Leoni / Grott Hard Café - Merging Technologies - Eventmore - CESMA