

GUEST EDITORS' NOTE

Special Issue on Advancements in Digital Audio Effects

In recent years, digital audio effects have seen a tremendous development. This is not only due to the availability of increasingly powerful software and hardware environments, but also to scientific advancements, such as the development of sophisticated algorithms, new mathematical representations, and novel paradigms, which allow us to process sound in a multitude of accurate, creative, and realistic ways.

In particular, new ideas for coping with aliasing in the virtual analog paradigm, new representation methods for 3D audio, new filter design or structures, and the influence of other fields such as neural networks and machine learning techniques could coarsely summarize the leading points of this recent progress.

The content of this special issue represents a slice of the current research trends which is far from being complete. Part of the content originates from the Digital Audio Effects conference (DAFx) held September 9–11, 2020, virtually from Vienna, Austria. Therefore, we include a brief conference report in this editorial.

We hope that this material will be the source of inspiration for new research and be of great interest for further developments.

DAFx

At its 23rd edition, the international conference series on Digital Audio Effects (DAFx) provides a unique window on the innovative research and development in this and in collateral fields. Indeed, the DAFx conferences are the meeting point for scientists, engineers, musicians, and artists who are developing and applying technology to audio in all its forms. DAFx developed to a rich community fostering new research and synergy between academic and industrial research.

The conference name originated from the European Union's COST-G6 project and the first public event, the DAFx'98 Workshop in Barcelona, Spain, in 1998. Over the years, the original title has been given a much broader meaning, encompassing all kinds of sound and music information processing by conceding that an audio effect is just about anything that sounds!

eDAFx2020

Due to the COVID-19 pandemic eDAFx2020 was the first virtual DAFx ever. Its online content, proceedings, presentations, and audiovisual streaming can be explored at <https://dafx2020.mdw.ac.at>. A virtual DAFx was a challenging task both for the authors, who had to cope with social distancing in research, and for the organizers, who had to establish new ways to deliver the content of the conference. In spite of that, the event successfully reached

a wide audience during live (over 2000 views) and off-line streaming. It received much positive feedback.

eDAFx2020 was chaired by Prof. Gianpaolo Evangelista of the University of Music and Performing Arts (mdw), Vienna, and organized by a team of people spanning several institutions in Vienna where active research on sound and music processing and acoustics is performed. These are:

The Institute for Composition, Electroacoustics and Sound Engineers' Education (IKE) at mdw
The Institute for Music Acoustics (IWK, Wiener Klangstil) at mdw
The Acoustics Research Institute (ARI) at the Austrian Academy of Science
The Numerical Harmonic Analysis Group (NuHAG) at the Vienna University

The members of the local (but virtual) organizing committee were:

Gianpaolo Evangelista (mdw)
Peter Balazs (ARI)
Monika Dörfler (NuHAG)
Nicki Holighaus (ARI)
Adrián Artacho Bueno (mdw)
Tommsch Mejsch (UniVie)
Konstantin Ulitsch (ARI)
Piotr Majdak (ARI)

The presentation of the papers at eDAFx2020 consisted of streamed audiovisual documents prerecorded by the authors, together with interactive question-and-answer sessions among authors and session chairs, with questions asked in the streaming chat. Altogether, there were seven sessions spanning three days, organized in the following six topics:

Spatial Audio and Artificial Reverberation
Virtual Analog
Audio Processing and Effects
Synthesis
Physical Modeling
Machine Learning and Analysis

eDAFx2020 relied on an army of over 200 reviewers, who helped by selecting and improving the manuscripts submitted by the authors. The manuscript selection was quite strict, given that out of 68 original submissions, only 43 papers were accepted (roughly 63%) after a 1+1/2 reviewing process, in which the less good papers were further scrutinized and, in a second review round, re-reviewed by the most critical reviewers.

In appreciation for the delicate task performed by the reviewers, for the first time in DAFx we also assigned "Best Reviewer Awards." François Germain received the first Best Reviewer Award, while the second Best Reviewer Award was given to Tommsch Mejschtrik.

DAFx20in21

The next DAFx conference, known as DAFx20in21, will again be virtually run from Vienna, September 8–10, 2021. The internet link will remain as that of DAFx2020: <https://dafx2020.mdw.ac.at>, emphasizing the repetition of the DAFx2020. Thus, a second volume of DAFx2020 proceedings will be edited, following the call for papers in 2021. We hope to be able to run an in-person DAFx conference in Vienna in 2022.

CONTENT OF THIS SPECIAL ISSUE

Half of the articles contained in this special issue are extended versions of papers presented at eDAFx2020. The paper by Davide Albertini, Alberto Bernardini, and Augusto Sarti titled "Antiderivative Antialiasing in Non-linear Wave Digital Filters" received the Best Paper Award at eDAFx2020. An extended version of this paper in the domain of virtual analog modeling is contained in this special issue.

Moreover, an extended version of the eDAFx2020 second best paper by Kurt J. Werner titled "Energy Preserving Time-Varying Schroeder Allpass Filters" in the domain of sound spatialization and reverberation is contained in this special issue.

Further extended versions of eDAFx2020 papers contained in this special issue are "Grouped Feedback Delay Networks for Modeling of Coupled Spaces" by Orchisama Das and Jonathan Abel, "Synthetic Transaural Audio Rendering (STAR): A Perceptive 3D Audio Spatialization

Method" by Eric Meaux and Sylvain Marchand, "Power-Balanced Modeling of Non-Linear Coils and Transformers for Audio Circuits" by Judy Najnudel, Thomas Hélie, David Roze, and Rémy Müller, and "Neural Modelling of Phaser and Flanging Effects" by Alec Wright and Vesa Välimäki. This brings about a good mix of topics in reverberation, spatial sound, physical modeling, and machine learning.

The following six papers are brand new: "Modal Decompositions of Impulse Responses for Parametric Interaction" by Jeremy Wells; "FPGA-Based Acceleration of FDTD Sound Field Rendering" by Yiyu Tan, Toshiyuki Imamura, and Masaaki Kondo; "Six-Degrees-of-Freedom Parametric Spatial Audio Based on One Monaural Room Impulse Response" by Johannes Mathias Arend, Sebastián Vicenç Amengual Garí, Carl Schissler, Florian Klein, and Philip W. Robinson; "Intelligent Control Method for the Dynamic Range Compressor: A User Study" by Shubhr Singh, Gary Bromham, Di Sheng, and George Fazekas; "An Evaluation of Click Detection Algorithms Against the Results of Listening Tests" by Frantisek Rund, Vaclav Vencovsky, and Marek Semansky; and "Guitar Effects Recognition and Parameter Estimation with Convolutional Neural Networks" by Marco Comunità, Dan Stowell, and Joshua Reiss. Again this brings about a good mix of topics in reverberation, spatialization, effects, detection, and machine learning.

With the present special issue consisting of 12 articles, we are happy to provide a broad sample of the ongoing research in the field of digital audio effects. We hope that this collection will stimulate further research in this growing field and will contribute to broaden active participation in the annual series of DAFx conferences.

**Gianpaolo Evangelista
Piotr Majdak
Peter Balazs**