GUEST EDITORS' NOTE
Special Issue on New Trends in Audio Effects II

In recent decades, digital audio effects rose to prominence thanks to the ubiquitous diffusion of computers and dedicated digital audio hardware in both the professional and consumer space. At the same time, dedicated scientific communities emerged to produce an ever-growing collection of advanced results to bring those digital audio effects to their full potential. The DAFx community, born of a European Union cooperation project with a first meeting held in 1998, forms an integral part of that rich history.

The yearly DAFx meetings, showcasing all aspects of signal processing as applied to audio, bring together this community. For years, this cross-disciplinary environment, marrying diverse fields from mathematics to physics and acoustics, brought great innovation in research and applications around audio processing and sound modeling. Recent years also saw the emergence of machine learning approaches, leading to a flurry of new and surprisingly effective methods. From that melting pot emerged digital replicas of vintage analog audio equipment through the use of virtual circuits. New models for sound spatialization are constantly being discovered, now with a fast-growing attention to virtual reality applications and beyond. In short, the curious reader never fails to find in the DAFx proceedings all manner of emerging trends in the field.

DAFx20in22

Because of the COVID-19 pandemic, the first two DAFx meetings (eDAFx2020 and DAFx20in21) of the 2020s had to be held in virtual form. At long last, the third one could be held in person in Vienna, Austria, using the acronym DAFx20in22. This 25th meeting demonstrated the eagerness of our community to unite once again and share the scientific and technological advancement in the field of digital audio effects and beyond (please see **https://dafx2020.mdw.ac.at/** for more info). The conference focused on topics like

- Virtual analog,
- Analysis and synthesis,
- Audio processing and effects,
- Physical modeling,
- Spatial audio and artificial reverberation, and
- Machine learning and music information retrieval.

The DAFx20in22 was chaired by Prof. Gianpaolo Evangelista of the University of Music and Performing Arts Vienna (MDW) 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 were

- 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 ; and
- The Numerical Harmonic Analysis Group (NuHAG) at the Vienna University.

The members of the local organizing committee were

- Gianpaolo Evangelista (MDW), conference, technical program, and publication chair;
- Peter Balazs (ARI);
- Monika D¨orfler (NuHAG);
- Nicki Holighaus (ARI);
- Adri´an Artacho Bueno (MDW);
- Tommsch Mejstrik (UniVie);
- Geraldine Ramphal (ARI);
- Piotr Majdak (ARI);
- Titas Lasickas (MDW);
- Georg Volkert (MDW);
- Clara Hollomey (ARI); and
- Daniel Haider (ARI).

We invited participants of DAFx20in22 and especially the authors who were winners of the best papers awards to submit to this special issue—the second one on New Trends in Audio Effects—of the *Journal of the Audio Engineering Society (JAES)*. We welcomed both original research papers and tutorials in one or more of the following topics:

- Representation, transformation, and modeling of audio signals;
- Audio transmission and resynthesis;
- Effects and manipulation of sound;
- Perception, psychoacoustics, and evaluation;
- Spatial sound analysis, coding, and synthesis;
- Sound source separation;
- Physical modeling, virtual acoustic, and analogue models;
- Sound synthesis, composition, and sonification;
- Hardware and software design for audio effects; and
- Music information retrieval and intelligent audio engineering.

Submissions were judged based on the academic quality, novelty, and relevance to the topic of digital audio effects.

DAFx23

This year, the 26th edition of DAFx—DAFx23—will take place in Copenhagen, Denmark (for more info, please see **https://dafx23.create.aau.dk/**).

CONTENT OF THIS SPECIAL ISSUE

This special issue contains six articles that put focus on a diverse collection of audio and music applications, ranging from synthesis models to spatialization and diffraction rendering in complex auditory scenes, from crossover filter design to automatic audio mixing, and from nonlinear processing to machine learning.

The first paper, "Crossover Networks: A Review," by Stefania Cecchi et al., presents an overview of crossover networks for multi-way loudspeaker systems and audio processing, focusing on their requirements and implementations both for analog and digital designs.

The second paper, "DDSP-Piano: A Neural Sound Synthesizer Informed by Instrument Knowledge," by Lenny Renault et al., is an extended version of the work that won the best paper award at DAFx20in22. This work proposes a polyphonic harmonic-plus-noise synthesizer whose parameters are optimized using deep learning on an annotated dataset of piano sounds.

The third paper, "Efficient Diffraction Modeling Using Neural Networks and Infinite Impulse Response Filters," by Joshua Mannall et al., focuses on diffraction rendering for the real-time plausible simulation of complex auditory scenes. It uses a machine learning approach that efficiently generates infinite-impulse-response diffraction filters from physically accurate simulated training data. Additionally, the data generation process is designed to be straightforwardly generalizable to higher-order diffraction rendering.

The fourth paper, "Mesostructures: Beyond Spectrogram Loss in Differentiable Time-Frequency Analysis," by Cyrus Vahidi et al., is an extended version of the work that won the second best paper award at DAFx20in22. It applies time-frequency scattering to the modeling of mesostructural musical audio (melody, arpeggios, syncopation, etc.), based on a differentiable arpeggiator.

The fifth paper, "Reverse Engineering a Nonlinear Mix of a Multitrack Recording," by Joseph Taylor Colonel and Joshua Reiss, deals with the problem of the automatic mixing of audio tracks with linear and non-linear processors. Using differentiable DSP models of the processors, the proposed structure learns the mixing parameters from a database of separate tracks and mixdowns.

The last paper, "Synthetic Transaural Audio Rendering (STAR): Extension to Full 3D Spatialization," by Sylvain Marchand and Eric Meaux, discusses extensions of a spatialization method published in the 2021 Advancements in Digital Audio Effects special issue of *JAES*, itself following up on the authors' contribution presented at eDAFx2020. The technique is here validated for the implementation of a 3D spatialization system, capable of fully controlling azimuth, elevation, and distance of the sound sources.

Ultimately, this special issue features a broad sample of the latest topics and trends in the field of digital audio effects. We hope that this collection will stimulate further research in this ever more relevant and growing field and will help broaden the reach of the annual DAFx meetings.

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