Editorial

Active Noise Control

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Active noise control generally aims at reducing an unwanted and unpleasant sound referred to as the noise. The general idea is very simple. However, there are many problems related to the acoustic phenomena as well as control limitations. Thus, the problem is still exciting and attracts attention of a number of scientists originating from different scientific disciplines. Rapid development of technology and extensive research allow for manufacturing sensors and actuators of more advantageous properties, designing more robust and effective algorithms, and finally performing successful applications in different noise polluted areas.

The aim of the special issue is just to present recent advances in active noise control and its applications. I would like to thank all the authors who accepted my invitation and decided to share their work with a wide circle of readers, what the open-access journal offers. The papers published in this issue were peer-reviewed by independent experts. I appreciate help of the experts very much. Even four reviews per paper were made. Therefore, the eight papers which are finally included in the issue are of very high quality. Below I am barely announcing main topics discussed in the issue.

A novel audiointegrated approach to achieving active noise control for incubators is proposed by L. Liu et al. The system reduces excessive broadband noise in neonatal care units and in incubators, which is generally due to ventilation or breathing equipment. Therefore, the system tries to protect against auditory damage to preterm infants both due to short-term and long-term effects. At the same time, the system recreates prenatal ambience for premature infants. In particular, an efficient robust nonlinear FXLMS-based adaptive control algorithm is presented. It allows for stable operation of the ANC system in the presence of impulsive interference in the input.

An integrated control system is designed by L. Wang et al. to improve bass reproduction of the audio equipment

and cancel engine noise in the cabins of automobiles. The problem is difficult because of the frequency overlap of the bass audio sound and engine noise. On the other hand, small volume of the cabin and poor low-frequency performance of loudspeakers need special approach. The proposed system equalizes the engine-noise harmonics based on the bass information to enhance the low-frequency part of the audio signal. The system responses also to variations of engine-noise frequencies. Multifrequency approaches to active noise equalization with frequency-sampling filters are used.

A system with a pair of loudspeakers is designed by D. Bismor to create a virtual unidirectional sound source. It enables successful cancellation of the acoustic feedback effect and, if supplemented by an active control system, efficient cancellation of the acoustic noise propagating downstream. Both fixed parameter and adaptive solutions are used. In the latter case, the problem of a hazard in tuning the virtual unidirectional sound source and active noise control algorithm is disclosed and guidelines for scheduling those operations are given. The overall system has been validated for noise control in an acoustic duct.

An active noise control system with online modelling of time-varying acoustic paths is designed by J. Yuan. Contrary to most publications, any external signal and thus persistent excitation is not required. Instead, orthogonal adaptation is used to cancel the acoustic feedback in order to recover the reference signal. The proposed system's behavior is stable and converges quickly even in case of significant and rapid changes of the acoustic path inside a duct.

A Hinf optimal control system with a pair of loudspeakers is proposed by Y. Kobayashi and H. Fujioka. As a fixed parameter solution it requires significantly less computations than an adaptive solution and still recovers benefits of the Swinbanks' source. However, by considering the pair of loudspeakers as two independent actuators, it gives more

flexibility and better noise control results are possible. The system is suitable for ventilation ducts in houses.

A modification of the FXLMS algorithm is proposed by S. P. Lovstedt et al. in order to compensate for its frequency dependent convergence behavior, which is particularly severe for plants responding with high peaks and deep valleys. Magnitude of the frequency response of the secondary path model is modified using a genetic algorithm to equalize eigenvalues of the autocorrelation matrix of the filtered-reference signal, while preserving phase of the frequency response of the model. As a result, higher attenuation and faster convergence are observed. In the experiments, swept tone noise and multiple tone noise, important in terms of many practical applications, are considered.

An active sound intensity probe consisting of a sound hard tube terminated by loudspeaker and equipped with a pair of microphones is designed by T. Kletschkowski and D. Sachau. Active control techniques are used to generate acoustic free field conditions in the tube. Thus, the probe acts as a local sound absorber and therefore the effect of the device on a source is reduced. The probe can be used for sound source localization, especially in weakly damped interior noise fields at low frequencies.

A state-feedback control system is proposed by V. Lhuillier et al. in order to reduce sound transmission through a panel excited by an acoustic wave. The effect of decreasing eigen frequencies of high-radiation modes and thus reducing vibration amplitudes at resonance frequencies by adding active modal masses is used. This effect can also be considered as virtual transformations of structures that can be used in the field of sound quality.

I believe that this special issue will be found interesting by the active noise control community.

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