11:40

5aSPa11. Vibration characteristics of microphone membranes. Holger Pastille (Inst. f. Tech. Acoust., Tech. Univ. Berlin, Einsteinufer 25, D-10587 Berlin, Germany, hp@stones.com)

Using laser scanners, the vibration pictures of the condenser microphone diaphragms were taken. In order to be monofrequent, the microphone was in an impedance tube. Standard microphones were used. The behavior of the vibrations can be well observed in the animated pictures. Besides the fundamental component, the nonlinear parts are also of special interest. Coherence between the sound-pressure level and the distortion of the microphone cap is seen. Seen also is the motion of the diaphragm itself. Results are shown for two studio microphones and a measuring microphone, each for three selected sound-pressure levels.

12:00

5aSPa12. Development of a multiprocessor system (HUGO) for acoustic applications. Jochen Kleber (Inst. of Tech. Acoust., Univ. of Aachen, Templergraben 55, 52056 Aachen, Germany, jkl@akustik.rwth-aachen.de)

For research in acoustics, audio signals must often be subjected to a complex processing. For listening tests, a real-time processing becomes desired in practice, in order to be able to switch between different situations. A free programmable device was implemented with up to eight channels with analogous and digital inputs and outputs. On four DSP's with a computing power of in total 160 MIPS, applications can be implemented. During design of hardware and software, it was considered to highest audio quality. In future this device can be used for other interesting developments, such as multichannel front ends with an A/D dynamics of 125 dB. In the paper, two applications will be presented more closely: crosstalk cancellation and binaural mixing console.

FRIDAY MORNING, 19 MARCH 1999 ROOM H111, 10:00 A.M. TO 12:20 P.M.

Session 5aSPb

Signal Processing in Acoustics and Engineering Acoustics: General Signal Processing in Acoustics

Kim C. Benjamin, Chair

Naval Undersea Warfare Center, 1176 Howell Street, Newport, Rhode Island 02841, USA

Contributed Papers

10:00

5aSPb1. Practical aspects of analyzing cyclostationary noise emitted by real acoustic sources. Karel Vokurka (Dept. of Phys., Tech. Univ. of Liberec, Hálkova 6, CZ-461 17 Liberec, Czech Republic, karel.vokurka@vslib.cz)

In previous presentations [K. Vokurka, J. Acoust. Soc. Am. **101**, 3045(A) (1997); **103**, 2819(A) (1998)] it was shown that time-frequency statistical characteristics of noise and vibration measured on reciprocating machinery yield information which can be conveniently used, e.g., in quality control or for diagnostic purposes. A basic assumption in developing suitable signal processing algorithms was that the number of samples in each period of cyclostationarity of the analyzed noise or vibration was exactly the same. However, this assumption is only seldom fulfilled by real acoustic noise or vibration. Hence, a suitable preprocessing technique must be applied to the measured signal. This technique may be either signal resampling, or external control of a sampling interval using multiple tachopulses, frequency multipliers, etc. In the paper, advantages and disadvantages of these techniques are discussed from the point of view of different types of measured acoustic noise or vibration signals, their possible phase modulations, and of the computed time-frequency statistical characteristics. [Work supported by the Grant Agency of the Czech Republic and by the European Commission.]

10:20

5aSPb2. Measurement of loudspeaker parameters by inverse nonlinear control. W. Klippel (Klippel GmbH, Aussiger Str. 3, 01277 Dresden, Germany, klippel-gmbh@t-online.de)

Nonlinear loudspeaker models have been developed to predict and explain the generation of nonlinear distortions in the reproduced sound at large amplitudes. These models require additional nonlinear parameters such as the force factor, stiffness of the mechanical suspension, and voice-coil inductance depending on the instantaneous excursion of the voice-coil. These parameters have to be measured dynamically since static approaches have shown to produce inaccuracies in describing the dynamic behavior of the loudspeaker due to hystereses and creep effects. The identification of the optimal model parameters can be accomplished by using an adaptive nonlinear system provided with the known input signal and an output signal measured on the speaker. An inverse nonlinear identification by using a nonlinear controller connected to the loudspeaker input has advantages over direct loudspeaker modeling in respect to robustness, convergence speed, and stability. Results of practical loudspeaker measurement are presented and discussed in respect to quality assessment of loudspeakers in the large-signal domain.

10:40

5aSPb3. Automatic classification of wideband acoustic signals. Alain Dufaux, Laurent Besacier, Michael Ansorge, and Fausto Pellandini (Inst. of Microtechnol., Univ. of Neuchtel, Rue A.-L. Breguet 2, CH-2000 Neuchtel, Switzerland)

Until now, very few contributions were published in the field of wideband acoustic signal recognition, especially for handling impulsive noise signals such as glass breaking, detonations, or door slams, as encountered in security applications, where the signals are highly nonstationary and composed of higher frequency components. This paper shows how the audio alarm recognition problem can efficiently be tackled using either pattern recognition methods relying on Bayes classifiers, or on artificial neural networks (ANN). After extraction of filterbank coefficients in the acoustic analysis module, typical feature vectors are achieved from the concatenation of k consecutive signal frames, in order to exploit dynamic temporal information. The redundancy induced by this dynamic modeling requires a reduction of the feature space dimension, performed with a conventional principal component analysis. The performance of both systems is evaluated experimentally (7000 tests) for the classification of three types of noise events (glass breaking, door slams, and stationary noises). The score of correct classification reaches 99% for the statistical approach,