

# Preface

Environmental noise is a big problem for human beings. Initially, noise level was the biggest problem. It has caused many bad effects, such as headache, discomfort, hearing loss, sleep disturbance. Long-term environmental noises also have deep effects and are integrated in the brain and body without any conscious awareness of them, as is discussed in Chap. 9. Particularly, the effects of the developments of unborn babies and the specialization of the cerebral hemispheres in growing children are serious. Numerous new technologies, such as noise insulation and active noise cancelling, have been developed and have contributed to the reduction of noise levels. But people feel annoyed even when the noise level is quite low because of the qualitative aspects of noises. In addition, the method of measuring and evaluating noise is still premature because the model of the auditory-brain system has ended at the peripheral level. Therefore, the development of measuring and evaluating the quality of noise based on our brain function is becoming more important for human beings.

This book deals with the methods of measurement and evaluation of environmental noise based on an auditory neural and brain-oriented model. The model consists of the autocorrelation function (ACF) and the interaural cross-correlation function (IACF) mechanisms for signals arriving at the two ear entrances. This model was based on neural evidence. First, we focused on the human auditory system, which was investigated mainly through the human brain and psychological response, such as by electroencephalography (EEG), magnetoencephalography (MEG), loudness, and annoyance, because the features of the human auditory system have to be taken into account in evaluating the quality of noises. The results suggest that the human auditory system has ACF and IACF mechanisms and the factors extracted from those mechanisms are useful as cues for temporal and spatial sensation of sounds.

It is hoped that the survey presented here will encourage researchers, students, and engineers in a wide range of fields, such as the automotive industry, the aerospace industry, mechanical engineering, railways, electronics industries, soundscape, architecture, and acoustics.

This book largely serves as a record of the research carried out at the Ando Laboratory, Graduate School of Science and Technology, Kobe University, between 1969 and 2009, even after the authors' graduation or retirement; as well as the studies conducted at the Living Informatics Research Group, National Institute of Advanced Industrial Science and Technology (AIST) between 2002 and 2015. The authors thank Dr. Shin-ichi Sato, Dr. Hiroyuki Sakai, Dr. Ryota Shimokura, Dr. Kenji Fujii, Dr. Seiji Nakagawa, and Dr. Mitsuo Tonoike for their collaboration and help.

March 2015

Yoshiharu Soeta  
Yoichi Ando

Neurally Based Measurement and Evaluation of  
Environmental Noise

Soeta, Y.; Ando, Y.

2015, XII, 264 p. 184 illus., Hardcover

ISBN: 978-4-431-55431-8