

経営情報学部・情報マネジメント専攻  
主催学術講演会  
日時：7月12日（木）、14:40～16:10  
場所：1号棟 1512 教室

Program in Information and Management Systems  
Graduate School of Comprehensive Scientific Research  
Prefectural University of Hiroshima, Hiroshima, Japan



## INVITED SEMINAR

Dr. Chuang Shi

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### Ultrasonic Audio and Directional Sound

**Abstract:** Active control of sounds usually contains two aspects. They are the active noise control and directional sound reproduction. The parametric loudspeaker utilizes an ultrasonic wave beyond the human hearing range as a directional carrier to deliver audible sounds to a targeted location. It becomes the best trade-off between the size and efficiency of the electro-acoustic emitter, as compared to the parabolic loudspeaker and loudspeaker array. Signal processing is of significant importance in the parametric loudspeaker to reduce nonlinear distortion and achieve controllable beam pattern.

This talk begins with the history and fundamental theory of the parametric loudspeaker. Several interesting applications are presented to highlight the merits of the parametric loudspeaker. The cause of the nonlinear distortion is explained from the nonlinear acoustic principle, followed by the recent development of the ultrasound-ultrasound Volterra filter that models the overall nonlinearity of the parametric loudspeaker. The directivity control of the parametric loudspeaker, or namely the steerable parametric loudspeaker, is also introduced. The long-known mismatch between the measured beam pattern and the product directivity is solved by the new convolutional directivity model. The derivation and experimental validation of the convolutional directivity model are hence elaborated. In the end, a use case of the parametric loudspeaker in active noise control is presented. It is found that when using two parametric loudspeakers to form a binaural active noise control system, the cross-talk secondary paths are trivial and thus can be ignored to save the computational power.

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**Biography:** Chuang Shi received his bachelor's degree in computer and information technology from Beijing Jiaotong University, Beijing, China in 2005, master's degree in precision instrument from Tsinghua University, Beijing, China in 2008 and Ph.D. degree in electrical and electronic engineering from Nanyang Technological University, Singapore in 2013. He was a postdoctoral researcher at Nanyang Technological University, Singapore, University of Electro-Communications, Tokyo, Japan and Kansai University, Osaka, Japan. He is currently an associate professor at the University of Electronic Science and Technology of China (UESTC), Chengdu, China. He is serving as an associate editor of the IEICE Transactions on Fundamentals of Electronics Communications and Computer Sciences from 2017 and a distinguished lecturer of the Asia Pacific Signal and Information Processing Association (APSIPA) in 2018. He won the best young presenter award from the Acoustical Society of America (ASA) in 2013. He has a variety of research interests in parametric loudspeaker, active noise control, microphone array, spatial audio, and acoustic scene classification.

**14:40 – 16:10, Thursday, July 12, 2018, Meeting Room 1512**

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