

Acoustics Laboratory

at the *Center for Noise and Vibration Control* in ME, KAIST

Overview

- **Supervisor:** Prof. Jeong-Guon Ih (e-mail: J.G.Ih@kaist.ac.kr)
 - *Ph.D. at KAIST (1985)*
 - *NVH Team Leader, Tech Center, Daewoo Motor Co. (1979-1990)*
 - *Prof. at KAIST (1990-Present); Head of ME Dept. (2012-2014); Dean of College of Eng. (2014-Present)*
 - *Vice President and President of the Acoustical Society of Korea (2004-2010)*
 - *Director of International Commission for Acoustics (ICA) (2010-Present)*

- **Major research area**
 - Inverse techniques in vibro-acoustics: *Rendering, measurement, identification*
 - Design of machinery with low noise & vibration: *Wave propagation concept*
 - Perceptual design of machine source and radiated field: *Auditory, haptic feelings*

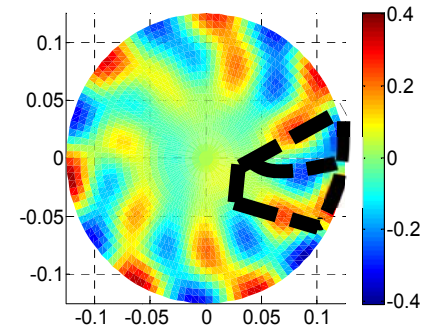
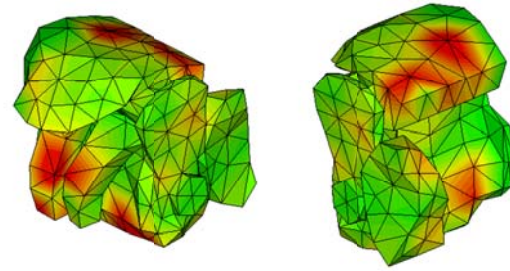
- **Lab. Members:** (as of December 2014)
 - Ph.D. Students: **5** (1 part-time student)
 - MS Students: **8** (3 foreign students)

- **Graduates:** (as of December 2014)
 - Ph.D.: **26**
 - MS: **50**



Major Research Applications

Near-Field Acoustical Holography



- **Study Purpose**

Identification of vibro-acoustic properties of sources with extended surfaces

- **Application Area and Topics**

Nearly all machineries radiating sounds – Structure-borne, air-borne, fluid-borne sources: car, engine, pump, home appliances, fuselage, submarine, ship, heavy machinery, compressor, piping, etc.

Evaluation and Design of Product Sound Quality (PSQ)

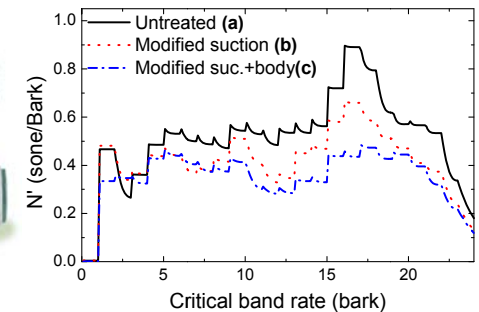
- **Study Purpose**

Psychoacoustic evaluation and design of product sounds based on the human perception

- **Application Area and Topics**

Any product which emits a sound having both negative and positive features:

various interior and exterior noises of cars (passenger car, motorcycle, commercial vehicles, etc.); some home appliances like vacuum cleaner, air conditioner, air cleaner, hair dryer, etc.; environmental noise; sound in an architecture or enclosure; audio systems and mobile devices; electronic machinery (ICT devices); emulation of sound; virtual reality, etc.



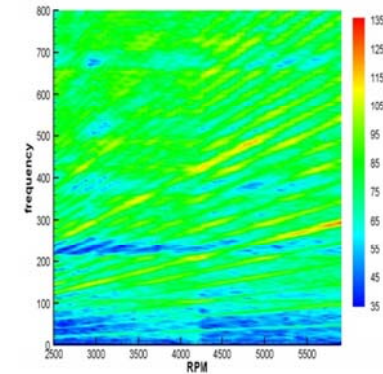
Silencing of Fluid-borne Noise in Ducted Systems

- **Study Purpose**

Design of the in-duct silencing system for the fluid machinery

- **Application Area and Topics**

Fluid machines that have intake and exhaust systems for the handling of fluid medium: internal combustion engine, compressor, pump, blower, etc.; vehicles, heavy machine, compressor, pump, HVAC system, enclosure, etc.



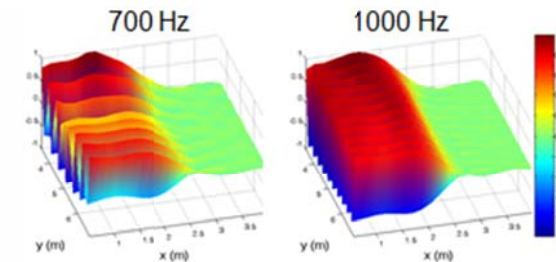
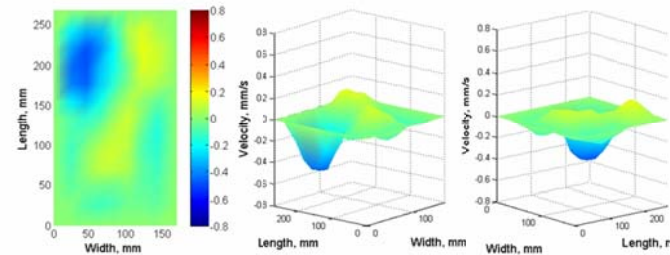
Rendering of Vibro-acoustic Field

- **Study Purpose**

Realization of virtual auditory and/or haptic experience of the machine users

- **Application Area and Topics**

Nearly all machineries radiating sounds: car, engine, pump, home appliances, fuselage, submarine, ship, heavy machinery, compressor, piping, etc.; ICT devices; public spaces, architectural environment, computer games, operation simulation for military service and vehicles, virtual reality, etc.



Current Research Works

Current Ph.D. Thesis Topics

- Inverse acoustic estimation of sectional temperature distribution in a duct (TK Kim)
- Inverse source identification of the rotating fluid machine in a wide duct with flow (YH Heo)
- Vibration field control using array actuators for reducing the radiated sound (SW Hong)
- Prediction of sound at the fairing of a launch vehicle at lift-off (SH Choi)
- Generation of localized vibration on a structure for a virtual sound radiator (JH Woo)

Recently Conferred Ph.D. Thesis Topic

- **Stabilization of time-domain acoustic boundary element method by wave vector filtering and non-uniqueness removal (HW Jang, 2012)**

Oey, H.-W. Jang, and J.-G. Ih, "Effect of Sensor Proximity over the Non-Conformal Hologram Plane in the Nearfield Acoustical Holography Based on the Inverse Boundary Element Method," Journal of Sound and Vibration, vol.329, No.2, pp.2083-2098, 2010.

H.-W. Jang and J.-G. Ih, "Stabilization of Time-Domain Acoustic Boundary Element Method for the Interior Problem with Impedance Boundary Conditions," Journal of the Acoustical Society of America, vol.131, No.4, pp.2742-2752, 2012.

H.-W. Jang and J.-G. Ih, "Stabilization of Time Domain Acoustic Boundary Element Method for the Exterior Problem Avoiding the Nonuniqueness," Journal of the Acoustical Society of America, vol.133, No.3, pp.1237-1244, 2013.

H.-W. Jang and J.-G. Ih, "On the Instability of Time-Domain Acoustic Boundary Element Method Due to the Static Mode in Interior Problems," Journal of Sound and Vibration, vol.332, pp.6463-6471, 2013.

Current MS Thesis Topics

- Leakage detection in a long pipe by using the inverse acoustic method (E Yadollahi)
- Vibration power flow near the bolted-joint in a structure (M Faiiazee)
- Generation of virtual pencil-writing feeling on a glass plate (DY Kim)
- Gas-attached, layered sound insulation system using the impedance mismatch (MY Seo)
- Simultaneous measurement of rotational and rectilinear vibrations by cameras (SW Kim)
- Optimized design of vibrational black hole by FEM (MS Kim @ DTU)
- Acoustic source localization by using the multiple 3D-intensity array (IJ Jeong)

Recently Conferred MS Thesis Topics

- **Incoherent source characterization by using the multiple 3D-intensity array and BSS technique (F Franek, 2014)**
 - F. Franek, J.-G. Ih, and E. F. Grande, "Localization of incoherent sound sources using a three-dimensional intensity array," Paper under preparation.
- **Generation of localized vibration on a thin plate for haptic sensation (JH Woo, 2014)**
 - J.-H. Woo and J.-G. Ih, "Vibration rendering on a thin plate by actuator array on the boundary," Inter-Noise 2014, November 2014, Melbourne, Australia.
- **A study on the condition monitoring of wind turbine gearbox (JH Bae, 2013)**
 - J.-H. Bae, J.-G. Ih, and S.-R. Kim, "Precise Order Tracking Analysis of Time-Varying Vibro-Acoustic Signature from Rotating Machines," Proc. of the 21st International Congress on Acoustics (ICA 2013), June 2013, Montreal, Canada.
- **Rendering of the desired sound field by source array determined in a holographic way (SW Hong, 2013)**
 - J.-G. Ih, W.-H. Cho, and S.-W. Hong, "Evaluation of System Configuration to Check the Suitability for the Sound Field Rendering Using the Inverse Approach," Proc. of the 21st International Congress on Acoustics (ICA 2013), June 2013, Montreal, Canada.

Current Contract Research Projects

- **Improvement of interior comfort of a future e-vehicle using the perception engineering** (National Core Research Center)
- **Inverse imaging of acoustic source and virtual field auralization** (National Research Foundation)
- **Development of a virtual pen being used on a glassy panel of ICT devices** (End-run Project, KAIST; under review)

Recently Finished Contract Projects

- **Generation of localized vibration for haptic perception** (Samsung Electronics Co., 2014)

Currently Pending Patents

- **Warning Sound System for EV:** System for generating the warning sound for an electric-motor driven vehicle
- **A pen-type interface system for virtually realizing the sliding resistance and texture feelings in using on a smooth surface**

For Further Detailed Information

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