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Title:

A MODIFIED LUMPED PARAMETER MODEL FOR MEMS MICROPHONE DEVELOPMENT

Abstract:

In this study, modified lumped parameter model (LPM) study for MEMS microphone (MM) is described. For analyzing MM's performance especially on SNR (signal to noise ratio), electro- mechano-acoustic coupling system was modeled by LPM and was matched with measurement data. By analyzing mutual dependencies of the different energy domain and calibrating model parameters, electrical, mechanical and acoustical domain components are concentrated on lumped terms. These lumped terms are analytic equations with modification factors. Analytic model for components are not always matched with real values because the real values are easily distorted by parasitic components. Therefore, we corrected the analytic components by modification factor. The modification factors of each component in LPM are calibrated by adapting measured data (frequency response and noise). We call it modified LPM. By this method, the design parameters for mechanical, electrical, acoustic lumped terms are close to the real values. Modified model shows high fidelity for measurement data. In order to increase SNR, we consider acoustic resistance of BPL hole. The acoustic resistance resulted by acoustic holes affects thermal noise of microphone directly. Instead of circle hole, diamond-shaped perforation structure on back-plate (BPL) was designed and its SNR performance was measured. The predicted SNR shows good agreement with measured SNR.

Biography:

Kumjae shin, Principal researcher, KITECH (Korea Institute of Industrial Technology)

Career

2016.3~2016.12, POSTECH, Vibration and acoustic transducer Lab., Post Doc.

2016.12~2017.12, DB Hitek, Specialized Process department part, Senior researcher
(MEMS microphone development, transducer modeling)

2017.12 ~now, KITECH, Principal researcher

Research interest

- ✧ MEMS microphone & hydrophone (Modeling, MEMS process, experimnts)
- ✧ Vibration and acoustic transducer (Sensor & Actuator)
- ✧ MEMS (Micro-electromechanical system)
- ✧ Sensor applied monitoring system (Sensor system)
- ✧ Electro-mechano-acoustic transduction modeling & Multi-physics modeling
- ✧ FET based transduction (Scanning Probe Microscopy, Acoustic sensor. Etc.,)