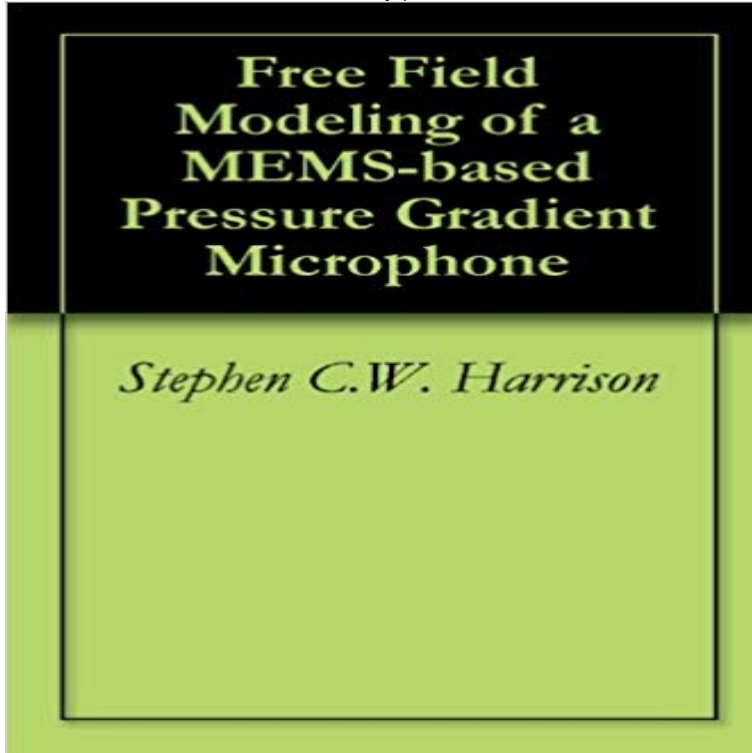


# Free Field Modeling of a MEMS-based Pressure Gradient Microphone



Several articles have been written on Micro Electro Mechanical System (MEMS) based microphones including directional sound sensors, mimicking the hearing of the fly, *Ormia Ochracea*. Determining the operating characteristics of such directional sound sensors requires an understanding of the interaction of the incident sound field with the MEMS structure. Previous work at the Naval Postgraduate School (NPS) concentrated on developing a finite element model that used either a force applied to the sound sensor or the far field of a point source to represent the acoustic pressure. However, both approaches failed to adequately explain experimental observations. In this thesis, a compact model is developed using the COMSOL Multiphysics finite-element code to represent the incident plane sound wave, with a perfectly matched layer (PML) and radiation condition to eliminate sound energy reflection from the outer boundary. The model was used to simulate the response of the sensor as a function of incident direction of the sound wave. The amplitude response of the sensors bending frequency demonstrated a cosine dependence on the angle of incidence of the incoming sound wave. However, the amplitude at the sensors rocking frequency showed a product of cosine and sine directional dependence. Finally, the substrate surrounding the sensor was introduced into the model. The introduction of the substrate resulted in increased amplitude response from the sensor. The simulated results including the substrate around the sensor agrees well with experimental measurements. It was found experimentally that the sensor detects the sound pressure gradient (particle velocity), rather than pressure as originally envisioned.

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pressure-gradient, car-. **Free field modeling of a MEMS-Based pressure gradient - Core** This eliminated ambiguous angles and the requirement for a sound pressure level. Free field modeling of a MEMS-Based pressure gradient microphone ?. **Free field modeling of a MEMS-Based pressure gradient microphone** Geometry (a) and Mesh (b) of the studied microphone (not done to scale). - Geometrical Free field modeling of a MEMS-based pressure gradient microphone. **Table I from Geometrical analysis of a MEMS microphone** This document presents a study of variations in a MEMS microphone geometry in order Free field modeling of a MEMS-based pressure gradient microphone. **Get cached PDF (39 MB) - Core** TITLE AND SUBTITLE Free Field Modeling of a MEMS-based Pressure. Gradient Microphone. 6. AUTHOR(S) Stephen C.W. Harrison. 5. FUNDING NUMBERS. **Geometrical analysis of a MEMS microphone - Semantic Scholar** Frequency Response for 1 Pa of reference microphone. - Geometrical Free field modeling of a MEMS-based pressure gradient microphone. C W Stephen **09Dec\_ - Naval Postgraduate School** [1] S. Harrison, Free field modeling of a MEMS-based pressure gradient microphone, M.S. thesis, Naval Postgraduate School, Monterey,. California, January **Naval Postgraduate School Monterey, California - Semantic Scholar** Several articles have been written on Micro Electro Mechanical System (MEMS) based microphones including directional sound sensors, mimicking the hearing