

Design and Simulation of a MEMS Directional Acoustic Sensor

S. L. Pinjare¹, V. S. Nagaraja¹, K. S. Rudresh¹

¹Department of ECE , Nitte Meenakshi Institute of technology, Bangalore, Karnataka, India

Abstract

A MEMS directional microphone has been designed and simulated using COMSOL Multiphysics® software. The microphone is inspired by the hearing mechanism of the fly *Ormea Ochracea*. The mechanical structure consist of two wings coupled at the centre. The wings are made of single crystal silicon of thickness 25 micron. The wing shape is designed to give multiple resonance frequencies in the range 100 Hz to 10 kHz. The sensing mechanism consist of four piezoelectric AlN films deposited on the wings. The overall size of the sensor is 2 mm by 1 mm. The sensor can be fabricated on SOI wafer using Piezomumps process. COMSOL Multiphysics® software is used to determine the resonance frequency of the structure . It uses Structural Mechanics interface. The Stress developed due to vibrating structure induces the charges on AlN piezoelectric film. Piezoelectric multyphysics interface is used to determine the charges and voltage developed across the film.

Reference

- [1] Yansheng Zhang, Windmill J.F.C and Uttamchandani, "Biomemetic MEMS Directional Microphone structures for Multiband Operations," Sensors IEEE, 2014, pp. 440-443.
- [2] Y. Zhang, R. Bauer, J. F. C. Windmill and D. Uttamchandani, "Multi-band asymmetric piezoelectric MEMS microphone inspired by the Ormia ochracea," 2016 IEEE 29th International Conference on Micro Electro Mechanical Systems (MEMS), Shanghai, 2016, pp. 1114-1117.
- [3] Micheal Touse, "Design, Fabrication and characterization of a Microelectromechanical Directional Microphone", Ph.D Thesis, Naval Postgraduate School, Monterey, California, June 2011.
- [4] Veda Sandeep Nagaraja and Sampatrao L. Pinjare, "Biologically Inspired MEMS Directional Microphone with Improved Sensitivity," Provisional Indian Patent. Application number : 3620/CHE/2015
- [5] Veda Sandeep Nagaraja¹, Rudresha K.J², S.L.Pinjare, "Design, Fabrication and Characterization of a Biologically inspired MEMS Directional Microphone", IEEE sensors communicated.
- [6] Y. Zhang, R. Bauer, J. F. C. Windmill and D. Uttamchandani, "Multi-band asymmetric piezoelectric MEMS microphone inspired by the Ormia ochracea," 2016 IEEE 29th International Conference on Micro Electro Mechanical Systems (MEMS), Shanghai, 2016, pp. 1114-1117.