Abstract

This report is written for the realisation of a group project by students from the Master Nanotech, joint venture between EPFLausanne, Phelma - Grenoble Institute of Technology and Politecnico di Torino. The aim of this work is to develop and engineer feeling and a team behaviour while conceiving an electronic nose.

This paper will describe :

- The project and its objectives
- The technical solution
- The achievements

An electronic nose is a device able to quantify an odour. The requirements of the product we implemented are the following:

- Portability: The e-nose must be portable in order to "smell" particular zones of a vehicle.
- Autonomous: The e-nose must be able to be operated without being plugged to a power source.
- Quick to use: The e-nose must give results in a decent amount of time and be able to be re-operated quickly.

Technological solutions considered

We have chosen to use coated SAW (Surface Acoustic Wave) sensors to quantify the chemicals present in the gas. The problem is that the sensing cells have to be desorbed after each use, which takes time. To compensate that we decided to implement a refillable sensing chip. Technically speaking, the work done was the simulation of the SAW sensor behaviour and the conception of the electronic circuitry which enables the detection of the the SAW output signal.

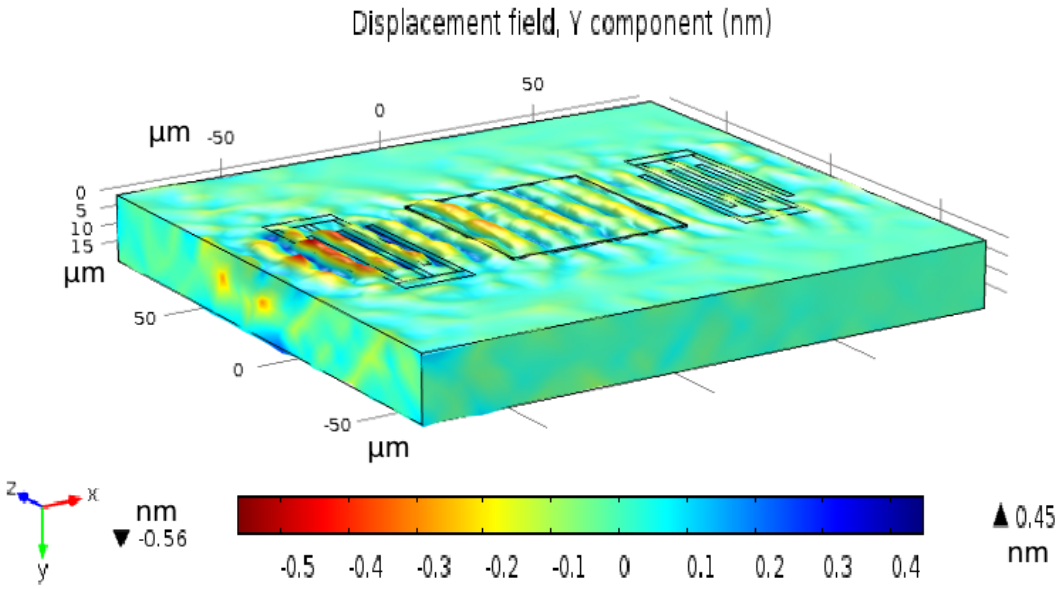

Figure 1 – Wave propagation through the simulated SAW sensor device

Electronic Ear

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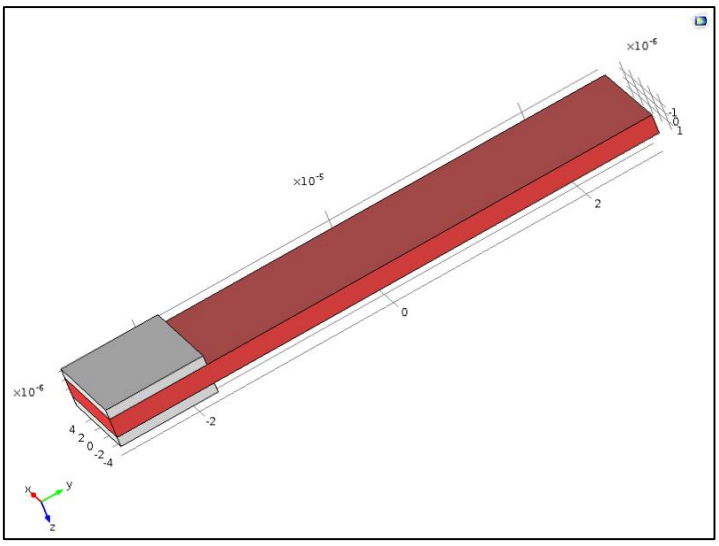
Abstract

In this report a new design for a fully-implantable, powerless cochlear implant which addresses sensorineural hearing losses is discussed. The basic idea was to create an array of transducers to achieve in-situ mechanical filtering of incoming acoustic waves, which are then transduced into an electrical potential through a piezoelectric material. Several structures were taken into account for the filters, until an array of cantilevers was selected as the best trade-off between dimensions, resonating frequency, displacement and coupling with the medium. Several simulations were carried on using Comsol Multiphysics tools, for which the results are here presented in details, as well as a possible implementation of the process flow required to realize the device. A biological study allowed to find coherent materials for the structure, both for biocompatibility and for mechanical properties. The aim of the project was to find an alternative approach for the design of cochlear implants, obtaining a non-conspicuous device with no need for daily maintenance or power resupply. The biological study, physical simulations and results reported and commented are extensively presented in the provided report.



Individual cantilever used for the array of transducers.