RESEARCH ARTICLE OPEN ACCESS

# Detecting Pressure from Aqueous-Blood Medium Using Simulated Tool

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**Abstract**
Technology is getting more advanced to give comfort life to every individual. One major problem faced by over worldwide is Diabetics. If earlier detected then precautions can be taken by self monitoring and controlling actions. Research is going on to have painless technique for detection of Diabetics. For this purpose many simulating software's like COMSOL Multiphysics, Intellisuite, Coventorware, ELMER, AnSys, MEMSCAD, MEMSPRO etc…are present for design nanosensor. This article makes use of COMSOL Multiphysics version 4.3a. Aims to detect pressure, displacement in blood medium.

## I. Introduction

WHO studies ha reveal that today maximum people are death due to Diabetes. Hence self monitoring and leading a healthy life is target today.[2-4]MEMS is one such leading domain which is used in Automotive, eletronics, Medical, communication ,defense etc. here we aim for medical application to design Nano sensor to detect blood glucose in blood.[5,6]

COMSOL Multiphysics is a tool which provides an excellent platform that allows us to examine all physics within one easy-to-use environment and optimize system operations before we start building prototypes. This provides simulating environment facilitates all steps of modeling process – [0]

**Generalize Algorithm can be illustrated as follows:-**
Step1: Defining Global Definitions
Step2: Modeling (repeat step 3 to 6)
Step3: Geometry
Step4: adding materials
Step5: adding required physics
Step6: Meshing
Step7: Studying
Step8: Results.

## II. Experimental work

Use of COMSOL Multiphysics version4.3a is used for studying the factors that affect Glucose level in blood. various affecting factors are pressure, stress, strain, velocity/speed of blood flow, fluid structure interaction, laminar flow, acoustic pressure ,temperature,etc in this articles few of above factors will be seen.

In this article 2-D *axis- symmetric model geometry is consider*. [1]Physics that had added in this design are combination of Pressure Acoustics, Frequency Domain and Piezoelectric Devices. And for studies frequency domain and Eigen frequency is considered. Materials are considered as blood aqueous medium and piezoelectric Barium titanate[BT]is used in devices. Geometrical structure is shown in Fig1. Domain analysis is shown in Fig2: i.e. blood medium and Fig 3: Pressure Acoustics, Frequency Domain.. Piezoelectric material is shown in Fig: 4

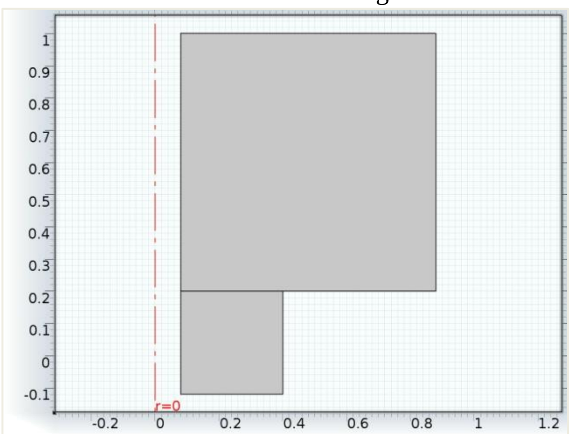


Fig:1 Geometrical structure.

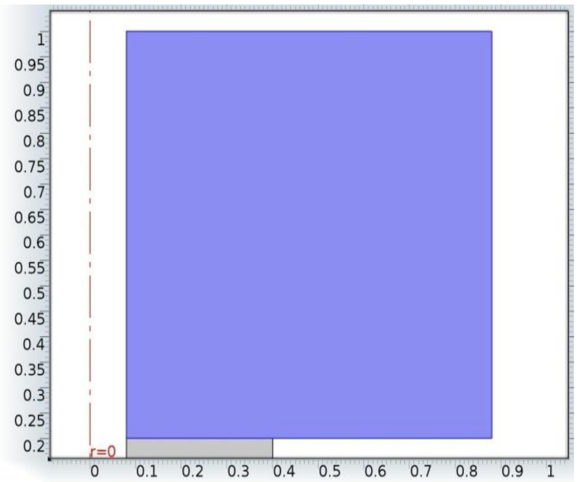


Fig2:Blood Medium

Domain 1 shows the liquid blood mediun in Laminar flow.

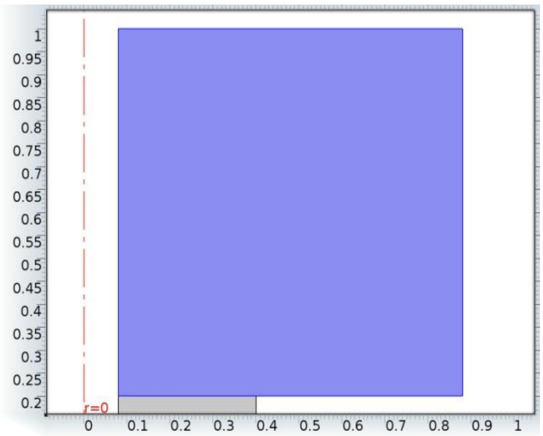

Fig 3: Pressure Acoustics, Frequency *D*omain

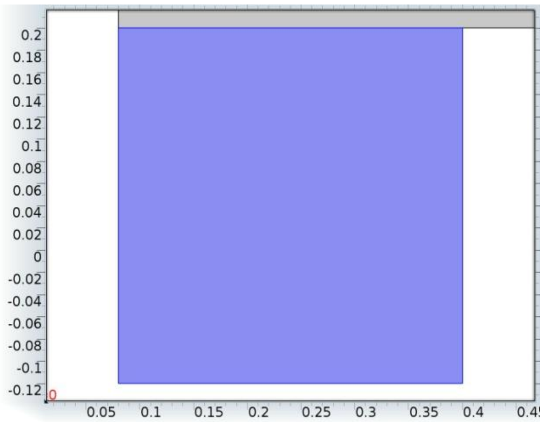
Fig 4: Piezoelectric Devices

After Modeling is completed Meshing is done. and shown in Fig5.

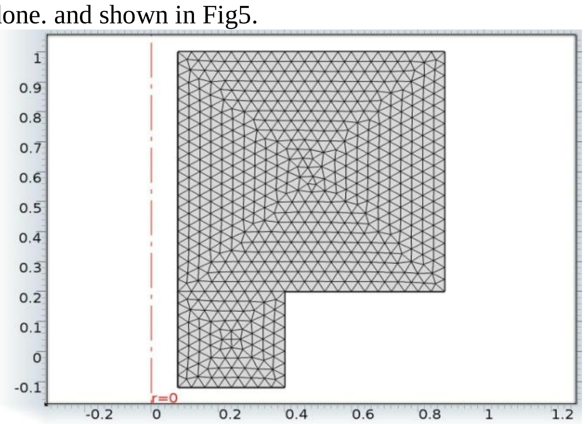

Fig:5 Meshing:

Then study is performed by using frequency domain and Eigen frequency. Accordingly the results are shown.from Fig6 to Fig11 and particle evaluation table is illustrated in Table1:

| Eigenfrequency | Frequency (Hz) |
|---|---|
| 2.88592e-4 - 252.58229i | 2.88592e-4 - 252.58229i |
| 0.032 - 80.67299i | 0.032 - 80.67299i |
| 9.17384e8 + 1.08618e7i | 9.17384e8 + 1.08618e7i |
| 9.20687e8 - 5.14907e6i | 9.20687e8 - 5.14907e6i |
| 1.04387e9 - 9.44109e6i | 1.04387e9 - 9.44109e6i |
| 1.30617e9 - 1.46747e5i | 1.30617e9 - 1.46747e5i |

Table :1 Particle Evaluation

**Acoustic Pressure (acpr)**

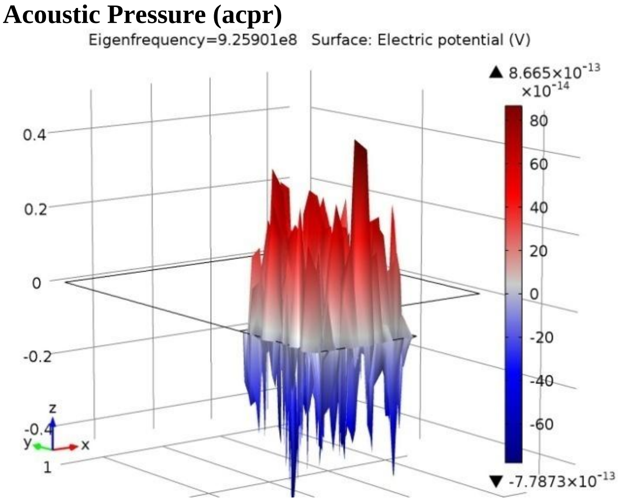

Fig:6-Eigenfrequency=9.25901e8 Surface: Electric potential (V)

**Sound Pressure Level (acpr)**

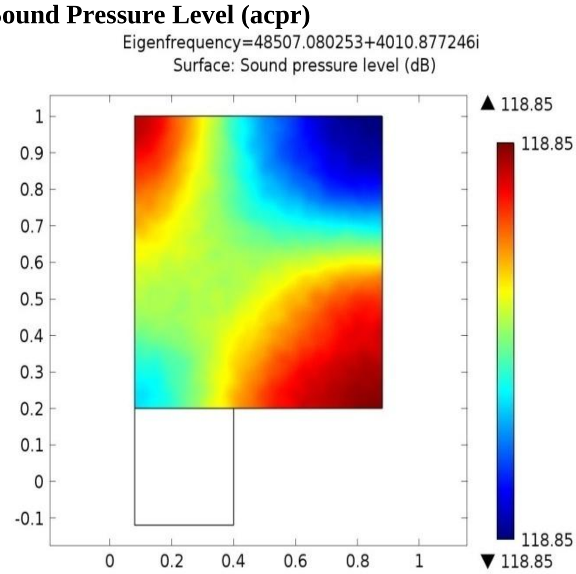

Fig7:Eigenfrequency=48507.080253+4010.877246i Surface: Sound pressure level (dB)

**Acoustic Pressure, 3D (acpr)**

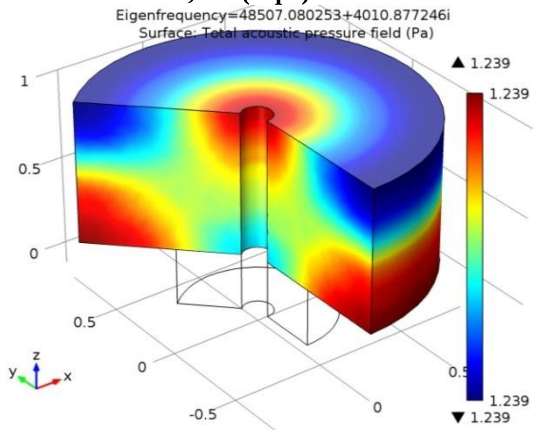


Fig8:Eigenfrequency=48507.080253+4010.877246i Surface: Total acoustic pressure field (Pa)

**Sound Pressure Level, 3D (acpr)**

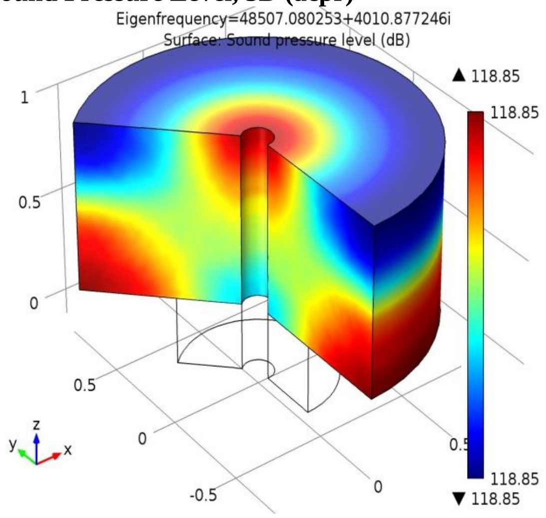


Fig9:Eigenfrequency=48507.080253+4010.877246i Surface: Sound pressure level (dB)

**Displacement (pzd)**

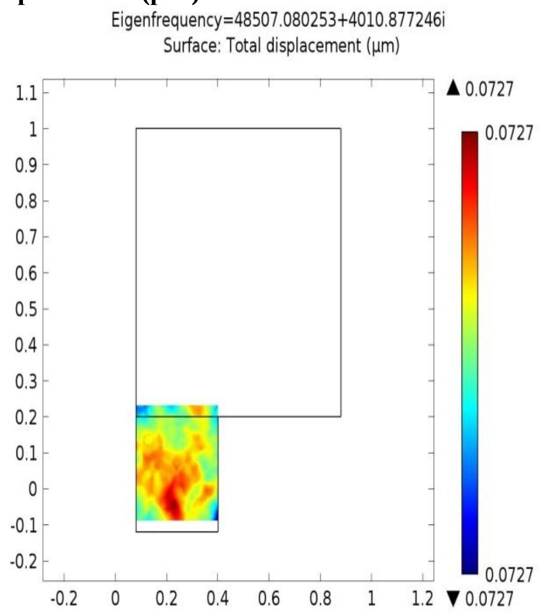


Fig10:Eigenfrequency=48507.080253+4010.877246i Surface: Total displacement (µm)

**Potential, 3D (pzd)**

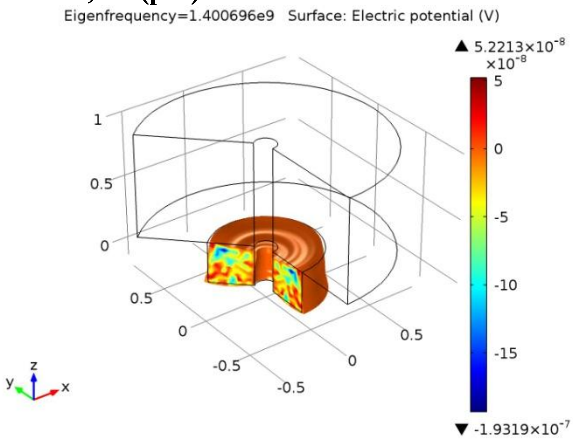


Fig11:Eigenfrequency=1.400696e9 Surface: Electric potential (V)

## III. Conclusion

In this article the results are based on factors of acoustic pressure, displacement-With respect to Eigen frequencies. Many other factors are to consider for exactly detecting glucose level in blood. Further articles will deal the other factors like stress, strain, density on blood medium which can affect glucose level in blood.

**References**

[1] COMSOL Multiphysics-product booklet2011 pg.no-9,14]

[2] P. Pattnaik, S. K. Pradhan, S. K. Kamilla, Debi Prasad Das" Studies of Lead Free Piezo-Electric Materials Based Ultrasonic MEMS Model for Bio Sensor"Except from proceeding 2012COMSOL conference in Banglore.

[3] *V. Mohan* et.al. *"Epidemiology of type 2 diabetes: Indian scenario", Indian Journal of medical Research, 125, March, pp 217-230 (2007)*

[4] Sarah Wild *et. A. l* "Global Prevalence ofDiabetes, *Diabetic Care*, 27, No 5, (2004).

[5] J. Diamond, "Diabetes in India", *Nature*, 26, pp 478-479, (2011).

[6] *Memscap,http://www.memscap.com*

[7] *Prime Faraday Techonolgy watch-Jan 2002"An introduction to MEMs'ISMn-1-84402-020-7.pg.no-1-29,42-43.*