Multiphysics Modeling and Simulation of Implantable Wireless MEMS Capacitive Sensor for Cardiovascular Diagnostics

R.Yogeswari,S.Venkateshwaran,K.Umapathi*

Department of Electrical and Electronics Engg, United Institute of Technology, Coimbatore, Tamil Nadu, India

Introduction: Cardiovascular diseases in most low and middle income countries is responsible for over 80% deaths. Blood pressure is a critical measure for cardiovascular health. Abnormal levels of blood pressure is indicative of several diseases like Hypertension, Atherosclerosis. The MEMS based implantable cardiovascular pressure sensor is a minimally invasive technique to continuously monitor the blood pressure.

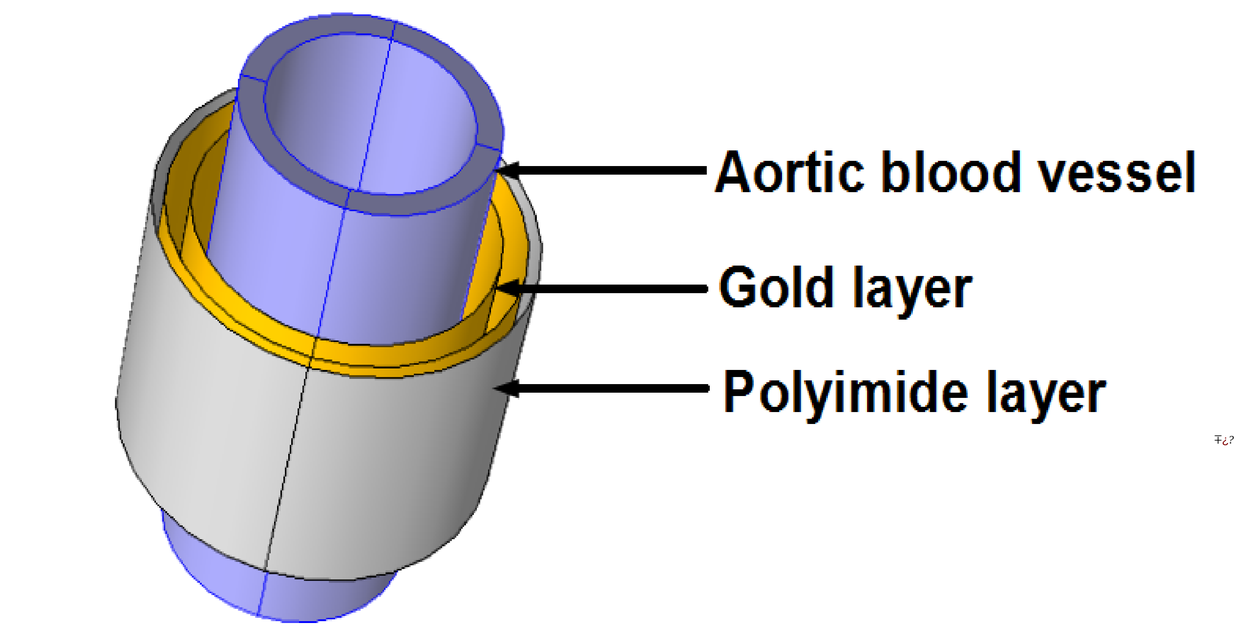

Figure 1. Proposed model with materials

Structural Description: The sensor employs gold plates as electrodes and polyimide layer to prevent direct contact between the electrodes and tissue. Structural mechanics physics is used to design the sensor.The displacements caused to the blood vessel at various levels of pressure is calculated.

Mechanical Properties of Mooney Rivlin:

Density	:	1102kg/m^3
Young's Modulus	:	5000kPa
Poisson's ratio	:	0.45

The thickness of gold layer is 16μm.The thickness of the the polyimide is 20μm.

Results: The displacements caused at different pressure levels is shown in Graph.

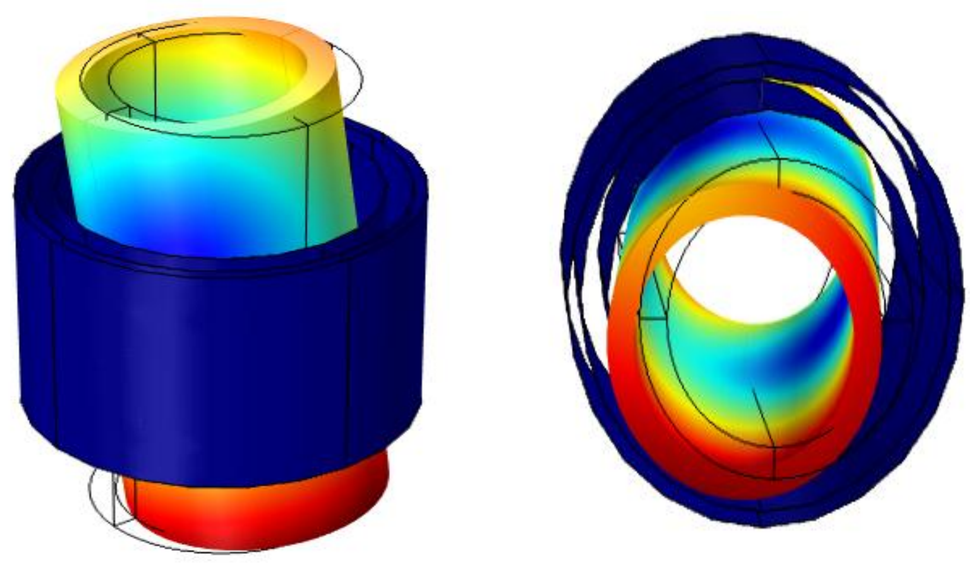

Figure 2.Displacement of blood vessel

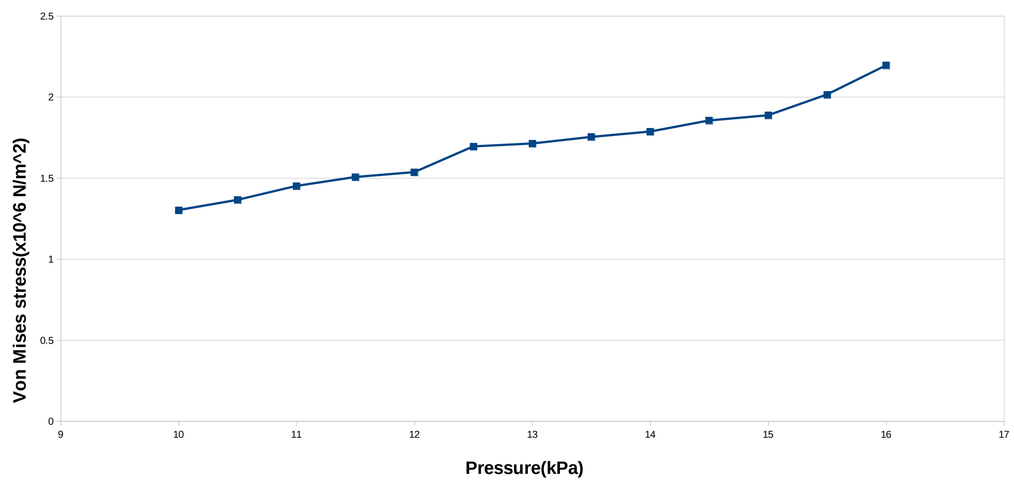

Figure 3. Variations in stress

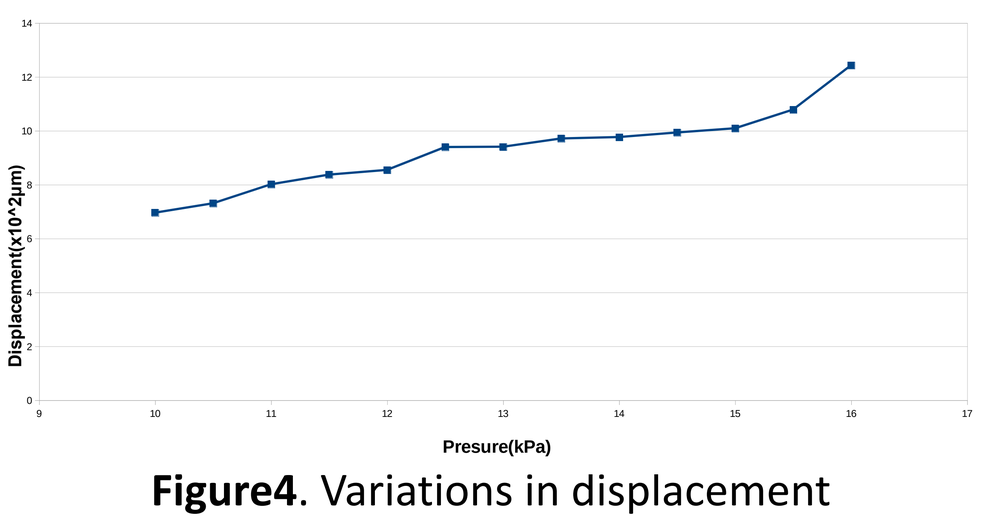

Figure4. Variations in displacement

References:

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2.R. S. Mackay and B. Jacobson, "Endoradiosonde," Nature, vol . 179,1957, 1239-1240.