Design of a MEMS Resonator for a Centre Frequency Greater than 26.35 MHz and Temperature Coefficient Frequency Less than 0.5 ppm

S.Manikandan[1], R.Radeep krishna[1]
1. Kalasalingam University, Department of ECE, Srivilliputtur ,Krishnan koil, Tamil Nadu, India

Introduction: **The variability of the design parameters caused by material properties like thermal conductivity is the major challenge in Micro Electromechanical System (MEMS). The change can be attributed to the stability in terms of frequency drift in parts per million (ppm) and Temperature coefficient of frequency (TCF).The research on filters, oscillators and sensors is related with Temperature compensated Resonator of high centre frequency and high Q factor.**

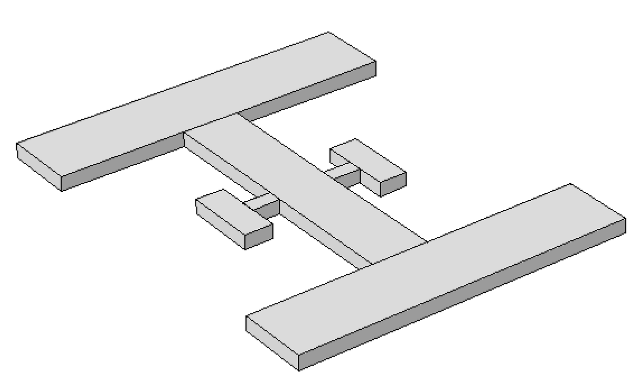

Figure 1. Resonator arrangement in COMSOL

Operation:

The electrodes are placed above resonator beam to make deflection. This voltage will cause change in natural frequency of resonator . Temperature compensation is done by using sio2 trenches in resonator beam. Need for sio2 is shown in Figure2.

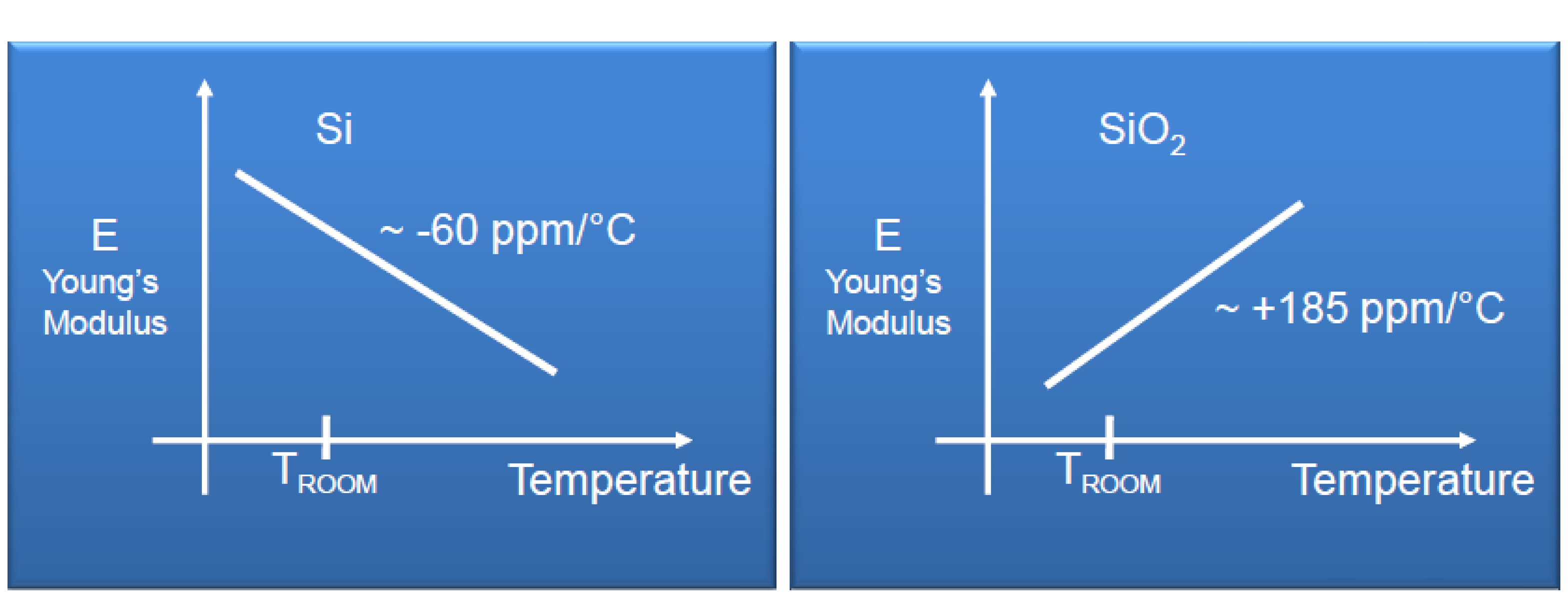

Figure 2. Si & Sio2 temperature variation

We can use other insulating material for temperature compensation. But mismatch between stress interface will occur. This will degrade the resonator performance.

Results: The displacement of resonator of the resonator structure shown in corresponding Figure 3

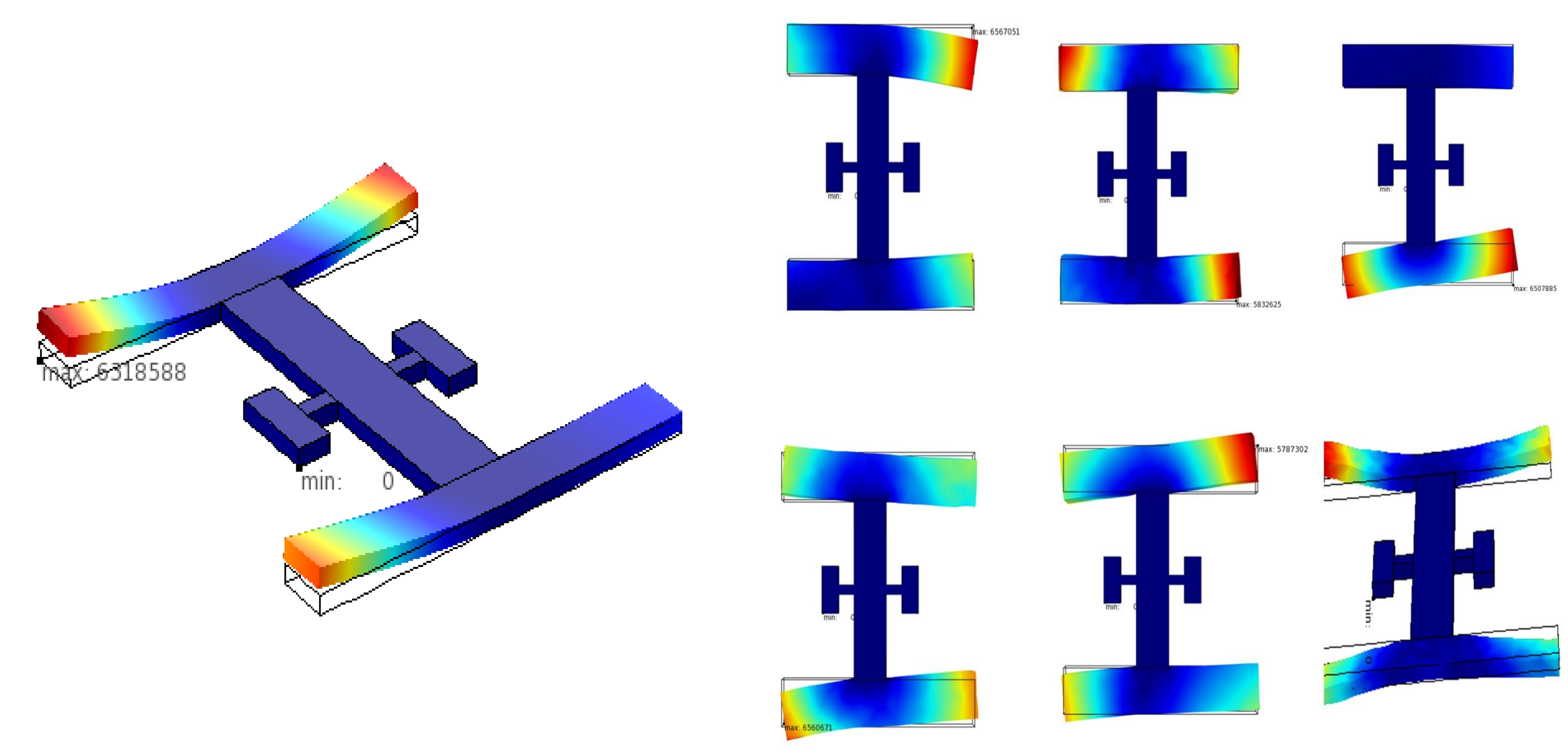

Figure 3. Displacement of resonator due to electrostatic force

Variable	Value	Units
Youngs modulus	160	Kpa
Density	2320	Kg/(m^3)
Poissions ratio	0.22	1
Co efficient of thermal expansion	2.6e-9	1/k

Table 1. material parameters

Conclusions:

We demonstrated a model of Temperature compensated model of electrostatically excited resonator . The future work is improving the thermal stability and high Q factor of MEMS resonator.

References:

1.Vickram A. Thaka,Zhengzheng Wu,et.al., Journal of micromechanicalsystem "Piezoelectrically Transduced Temperature-Compensated Flexural-Mode Silicon Resonators".
2. Roozbeh Tabrizian, Giorgio Casinovi,et.al., "Temperature-Stable Silicon Oxide(SilOx) Micromechanical Resonators" IEEE Transactions on Electron Devices,