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Structural Modifications and Applied Force Response Analysis of MEMS Based Device

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Abstract

In this paper our intention is to alter the dimensions of a MEMS based structure and to investigate the possible facts about the variation of Eigen frequencies displacement and few mechanical properties. To obtain the proposed goal we have simulated their target structure in Multiphysics environment using finite element method. We have considered two different cases, with and without force. Applied force is 10N/M^2 in Z-direction on the fourth surface of the structure. In this work Nylon has been used as a material and second surface of the structure has been fixed as a cantilever structure. Finally maximum displacement has been shown through simulation results.

Keywords:*Dimensions,Multiphysics,Eigenfrequencies,Displacement.*

I INTRODUCTION

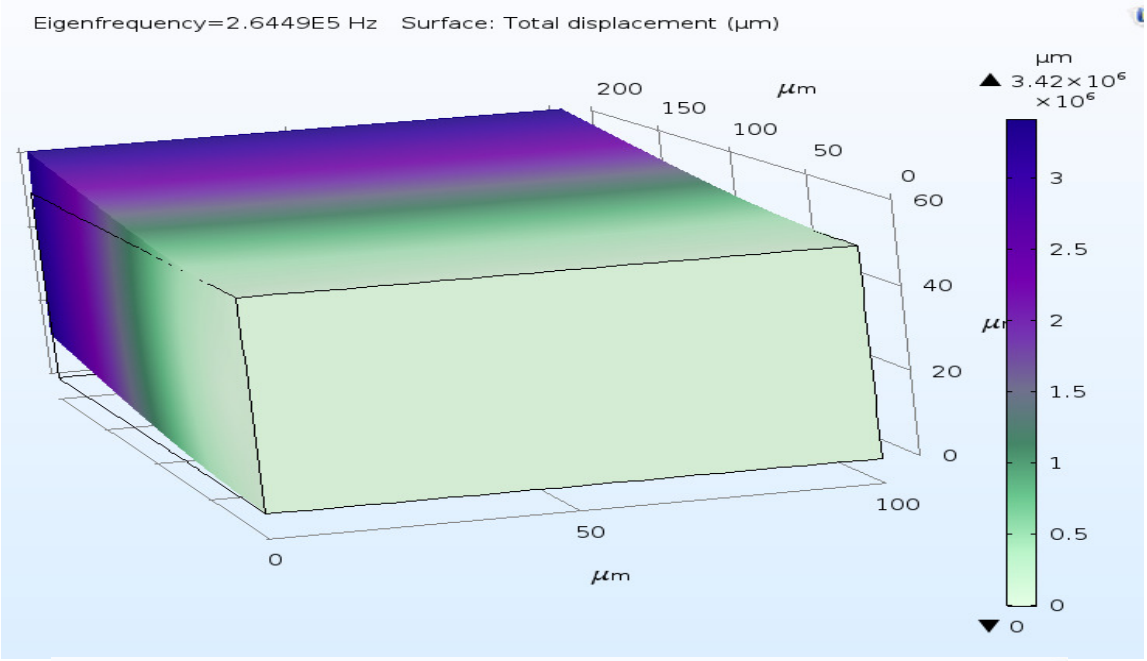
Now-a-days importance of micro and nano scale technology is rapidly growing in all fields and sectors. MEMS (Micro-Electro-Mechanical Systems) are a driver for multiple and mixed technology integration [1]. MEMS are collection of more devices where microprocessors and mechanical parts along with signal processing circuits are integrated on a small piece of silicon [1-3]. Its primary unique feature is miniaturization, multiplicity as well as microelectronics like Sensors and actuators [6 &7]. MEMS can be more advantageous for its low power consumption, high sensitivity, low weight, less cost [8]. There are many different sensing materials available to fabricate the MEMS devices [1-5].

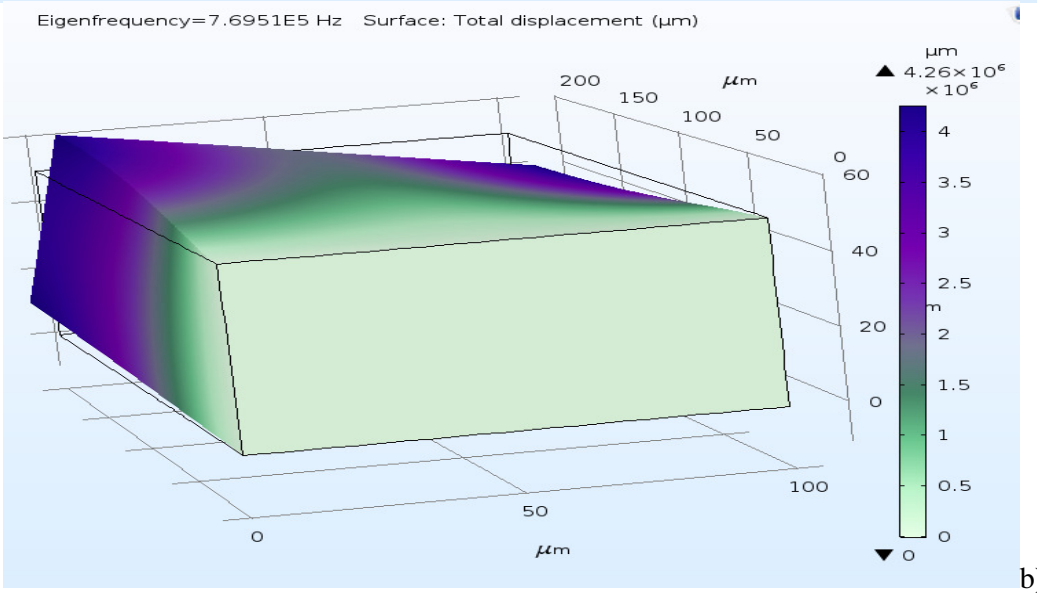
For better performance characteristics, some of the materials are highly suitable [3].Nylon fibers are exceptionally strong and elastic and stronger than polyester fibers. The fibers have excellent toughness, abrasion resistance, and are easy to wash, and to dye in a wide range of colors. The filament yarns provide a smooth, soft, and lightweight fabric of high resilience. Nylon is used in the garment and home furnishing industry. However, due to its higher price and lesser wrinkle resistance, it has been replaced by polyester in many garment products. Yet, it remains an important fiber for more demanding applications, including tire cords, ropes, seat belts, hoses, conveyer belts, carpets, parachutes, racket strings, sleeping bags, tents, and various civil engineering materials.

II DESIGN AND ANALYSIS:

The below table represents the behavior of the MEMS structure with nylon material by applying with and without force.

Dimensions (µm)	Material	Study Type
L=200 W=100 H=50	Nylon	Eigen frequencies





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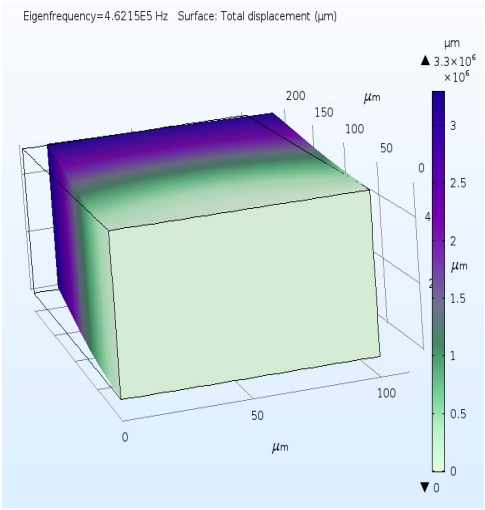
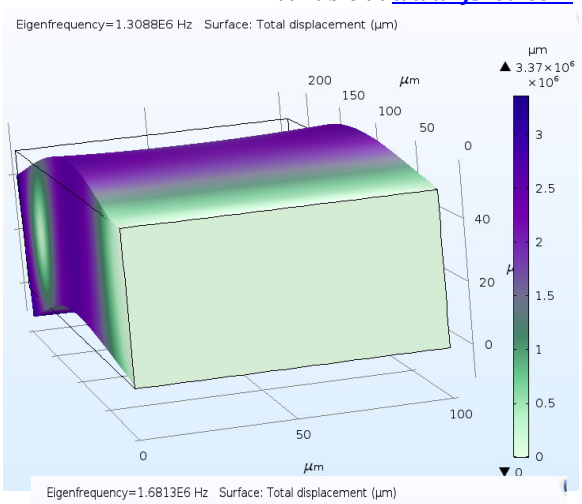
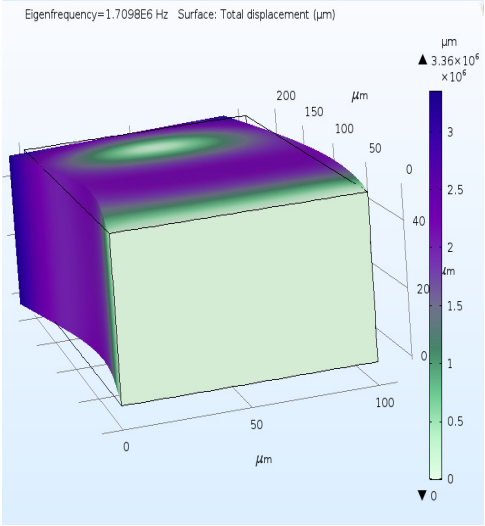
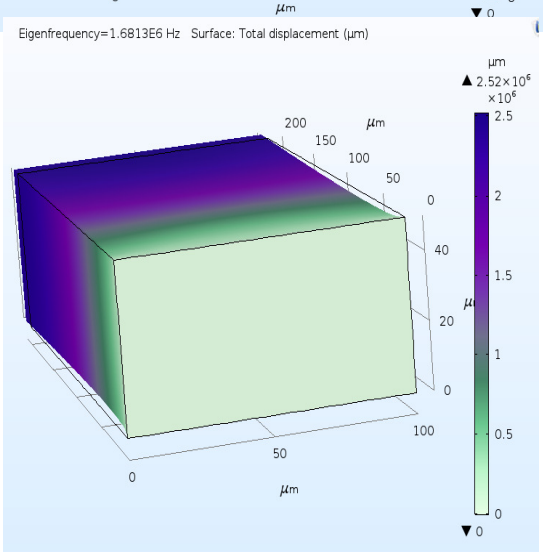








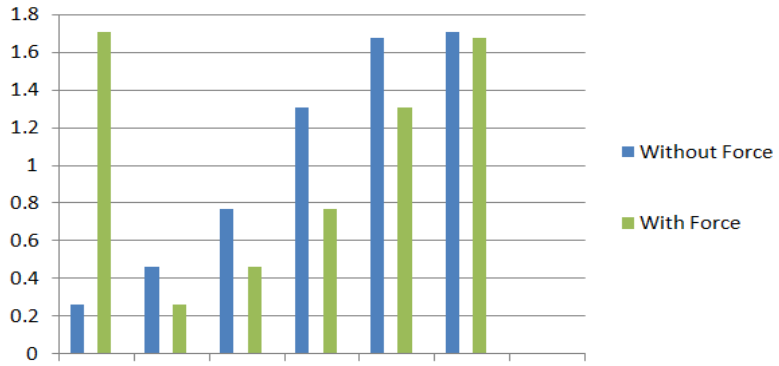
- Applied force=10N/m^2 with same dimension

Graphical Analysis

Without Force(X E6)	With Force(XE6)
0.26449	1.7098
0.46215	0.26449
0.76951	0.46215
1.3088	0.76951
1.6813	1.3088
1.7098	1.6813

This graph shows the performance of the MEMS structure using Nylon material by applying the with and without force. The table represents the different values of Eigen frequencies by applying with and without

force. Based on the observations Nylon polymer can be used as good sensing material for maximum displacement at less amount of force.



CONCLUSION

Thus *to obtain the proposed goal we have simulated their target structure in Multiphysics environment using finite element method. We have considered two different cases, with and without force. Applied force is 10N/M^2 in Z-direction on the fourth surface of the structure. In this work Nylon has been used as a material and second surface of the structure has been fixed as a cantilever structure. Finally maximum displacement has been shown through simulation results.*

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