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# DISPLACEMENT-AMPLIFYING COMPLAINT MECHANISM FOR SENSOR APPLICATIONS FOR VIBRATION MEASUREMENT IN INDUCTION MOTOR

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***Abstract***
The topic of the paper is displacement-amplifying compliant mechanisms (DaCMs), which employ a single elastic continuum and the input force applied at one location to produce amplified output displacement at a different point. In order to accurately represent the static and dynamic behavior of DaCMs, we created a spring-mass-lever model. Using a combined Figure of Merit, we used this model to evaluate the topologies of DaCMs for sensor applications using a number of criteria. When none of the DaCM topologies in the database can fully satisfy the needs of a new sensor, we use topology optimization to create a new DaCM. In order to include them in the optimality criteria approach, which is utilized to solve the topology optimization problem, these nonlinear constraints have to be linearized. Two applications of DaCMs, namely, a bulk-micromachined high-resolution accelerometer and a minute mechanical force sensor are pursued in this work.

*1.* ***Keywords:*** *Induction machines, harmonics, hysteresis, saturation, mechanical vibrations.*

## 1. INTRODUCTION

The focus of the paper is on compliant mechanisms, which amplify displacement at one point of an elastic continuum by using the force applied at another. Thus, the single-piece elastic body that makes up a compliant mechanism behaves rather stiffly like a lever. This work takes into account two uses for a Displacement-amplifying Compliant Mechanism (DaCM), namely a high-resolution micro-machined accelerometer and a tiny mechanical force sensor. The thesis includes thorough computational and analytical modelling, methodical design, including topology optimization, and testing of two devices.

## 2. Structural Analysis Of DaCM by Solidworks Structural Analysis.

Figure 1: Structural Analysis of M1 Structure

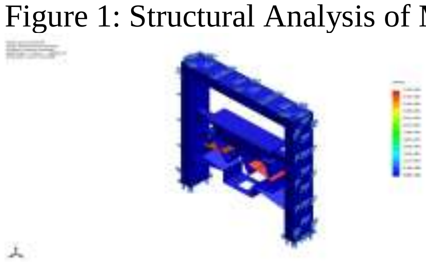

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Figure 2: Structural Analysis of M1 Structure

Figure 3: Structural Analysis of M1 Structure

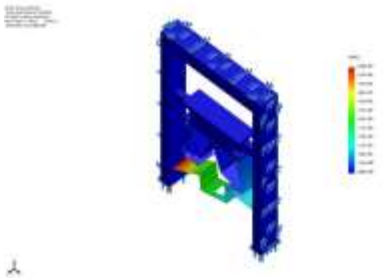

Figure 4 : Structural Analysis of M1 Structure

**3. Results Obtained by Frequency Analysis**

| Frequer Numb | Rad/s | Her | Secon |
|---|---|---|---|
| 1 | 0.153 | 740 | 41.04 |
| 2 | 0.732 | 760 | 8.578 |
| 3 | 53.74 | 775 | 0.1169 |
| 4 | 54.43 | 770 | 0.1154 |
| 5 | 116.2 | 771 | 0.0540 |

| Mode Number | Frequency(Hertz | X directi | Y directi | Z directic |
|---|---|---|---|---|
| 1 | 740 | 1.2178e | 0.00233 | **1.7202e-0** |
| 2 | 760 | 0.0013 | 1.0524e- | **0.0010198** |
| 3 | 775 | 5.5946e | 1.6374e- | **7.2929e-0** |
| 4 | 770 | 8.0157e | 2.313e- | **1.0461e-0** |
| 5 | 771 | 0.0011 | 0.00130 | **2.266e-00** |

Table : Results Obtained by Frequency Analysis

**4. Conclusions**

Understanding displacement-amplifying compliant mechanisms (DaCMs) and looking into its applicability for sensor applications are the project's main goals. In order to do this, a lumped spring-mass-lever model for the DaCM has been presented, which represents both its static behavior and the dominant-dynamic mode. These models have been used to categorize and assess different requirements that are crucial for sensor applications. A number of realizations were made, most notably the significance of net amplification for sensor applications as opposed to inherent amplification. To create a catalog of DaCM topologies, several mechanisms from the literature were taken into account.

***Appendix***

EFFECT OF FABRICATION LIMITATIONS ON THE RESOLUTION OF AN ACCELEROMETER

.**References**

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