Sensor Technology | ELCT 903 | 9th Semester | Mechatronics Engineering | Engineering and Material Sciences

Force Capacitive Sensor

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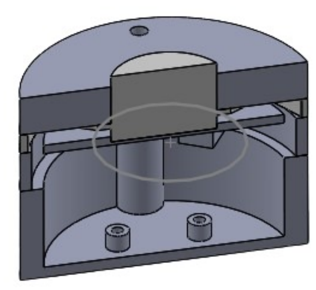
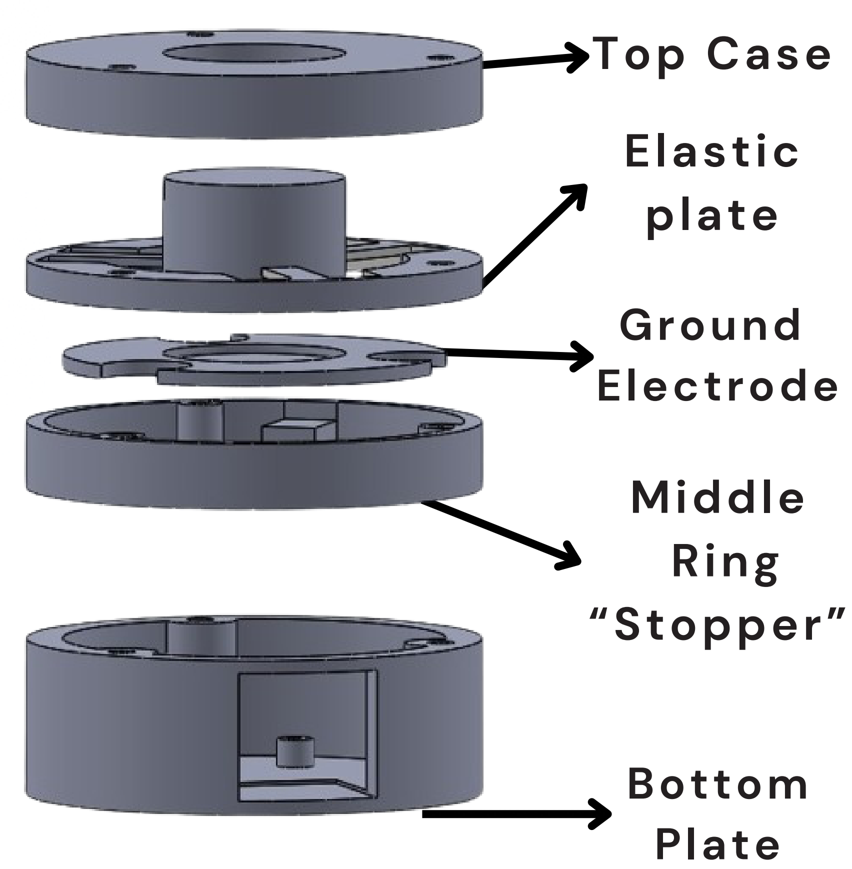
OBJECTIVE

Converting physical applied forces into measurable changes in capacitance.





METHODOLOGY

The application of force leads to a alteration in the distance between the two electrodes, resulting in a change of capacitance. This change is then transmitted to a linearization circuit and the measurements are observed on an oscilloscope and quantified.

$$C = \varepsilon_0 \varepsilon_r \frac{A}{d}$$

ANALYTICAL WORK

Mechanical Model:

$$T = \frac{1}{2} m\dot{x}^2 \qquad V = \frac{1}{2} kx^2 \qquad D = \frac{1}{2} b\dot{x}^2$$

$$m\ddot{x} + b\dot{x} + kx = f(t)$$

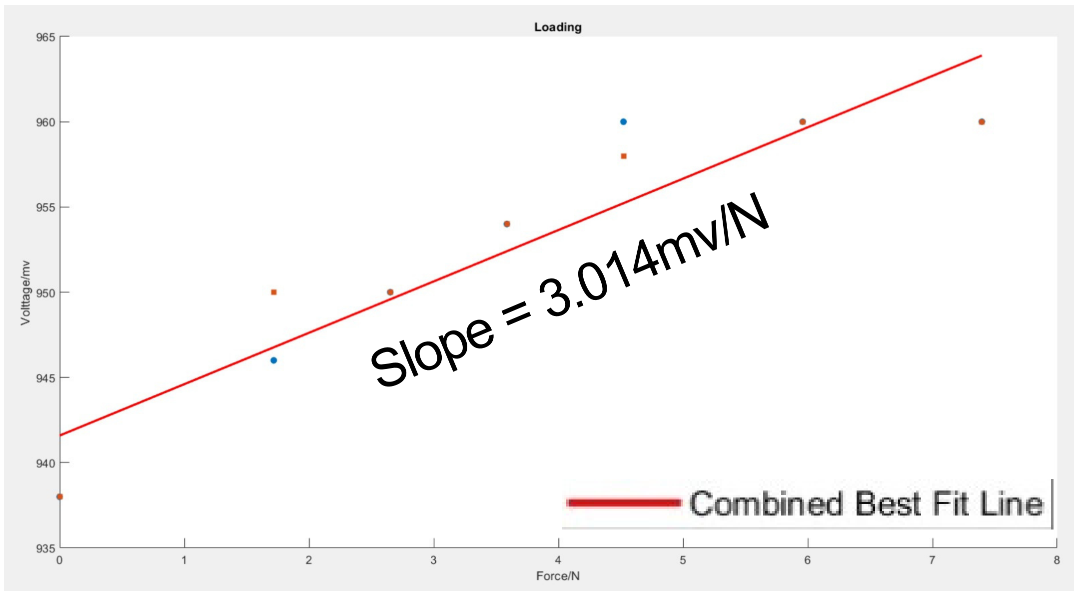
Electrical Model:

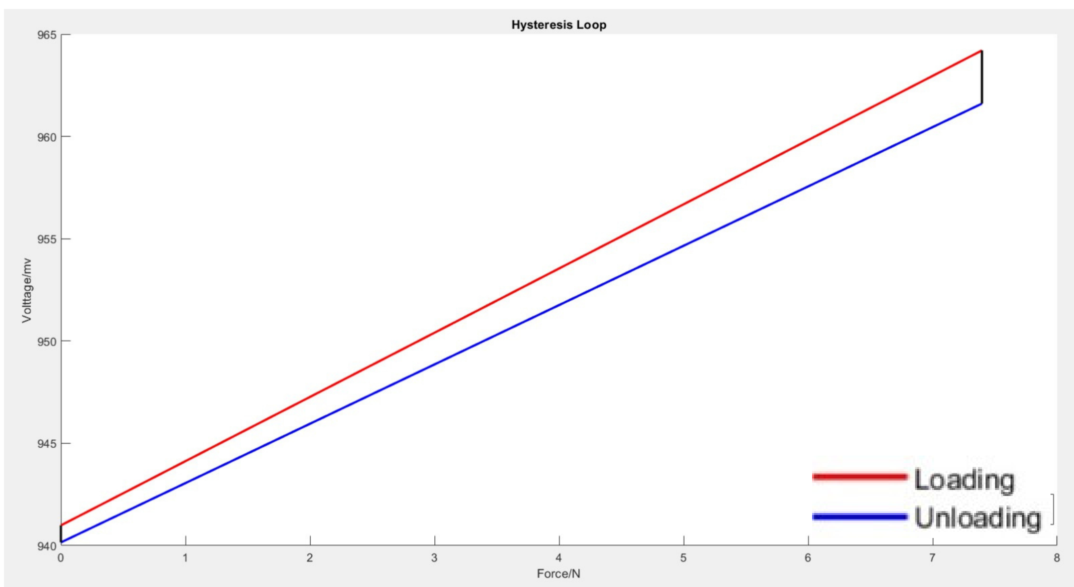
$$V = \frac{1}{2}\frac{1}{C}q^2 = \frac{1}{2}\left[C1 + Cmeasuresd\right] V_c^2$$

$$D = \frac{1}{2} R\dot{q}^2 = \frac{1}{2} R\left[C1 + Cmeasuresd^2\right] \dot{V_c}^2$$

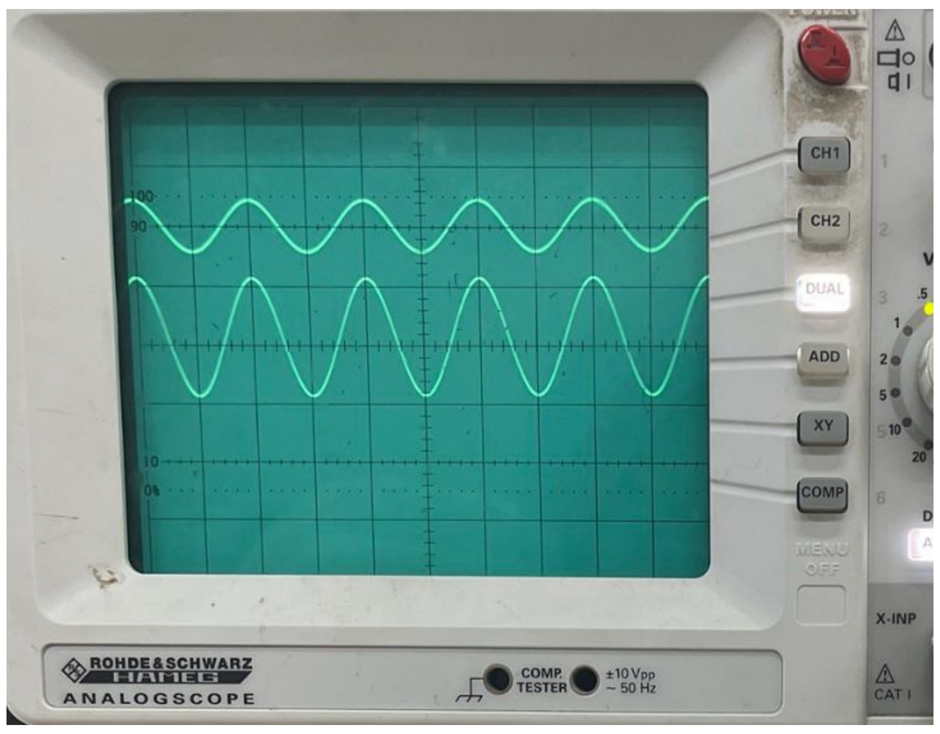
$$R\left[C1 + Cmeasuresd^2\right]\dot{V}_c + \left[C1 + Cmeasuresd\right] V_c = f(t)$$

EXPERIMENTAL WORK

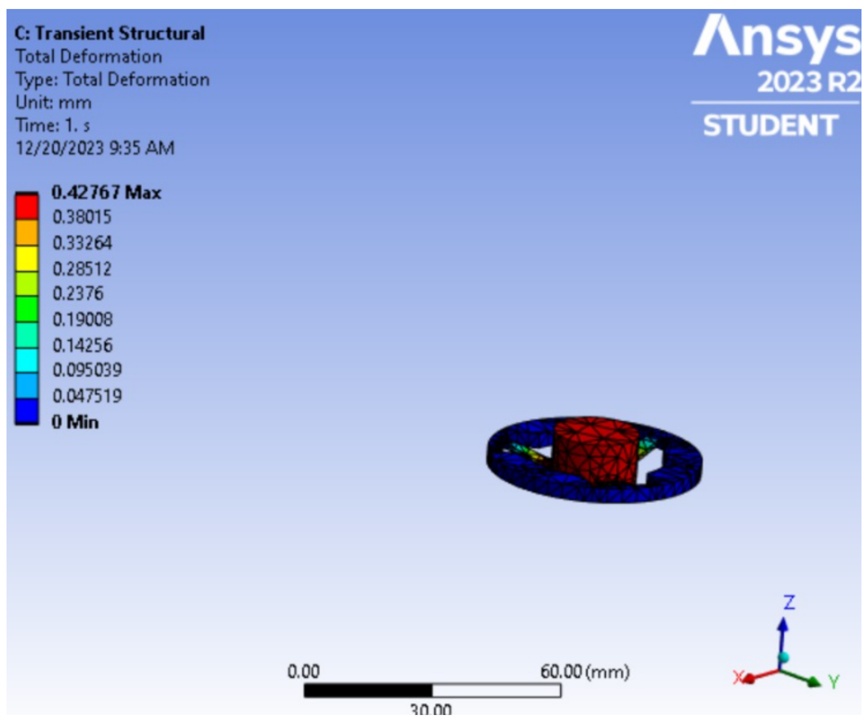


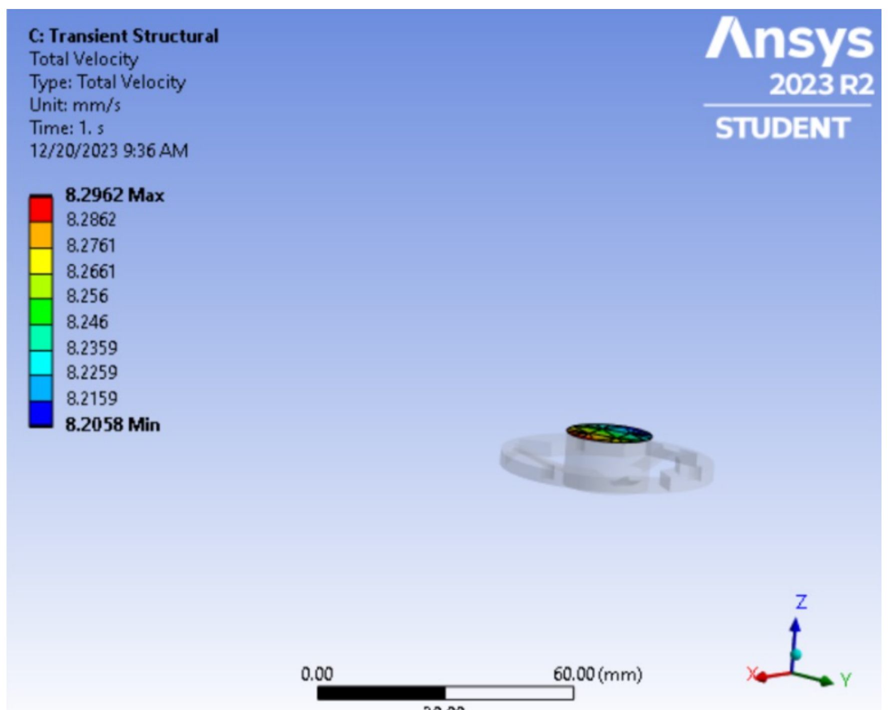


Hesteresis = 7.73%



RESULTS and CONCLUSIONS





δ = 0.038 Maximum Overshoot = 0.887

Resonance Frequency = 72.9 Hz

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