

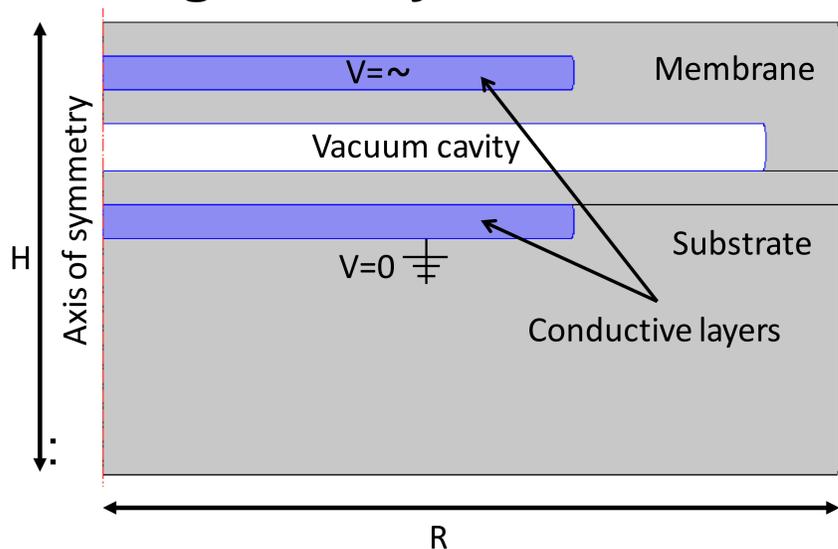
# Development of a Micro Ultrasonic Transducer

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**Introduction:** A Capacitive Micromachined Ultrasound Transducer (CMUT) is a microelectromechanical system. We simulate a CMUT coupling electrical and structural mechanics to describe its dynamics. We obtain the distributions of the electric field, stress, time evolution and maximum frequency of operation

## CAD geometry



**Figure 1.** Main features of the simulated acoustic transducer. Typically  $R \gg H$ .

## Domain and boundary equations:

$$V = V_0 \sin(2\pi ft)$$

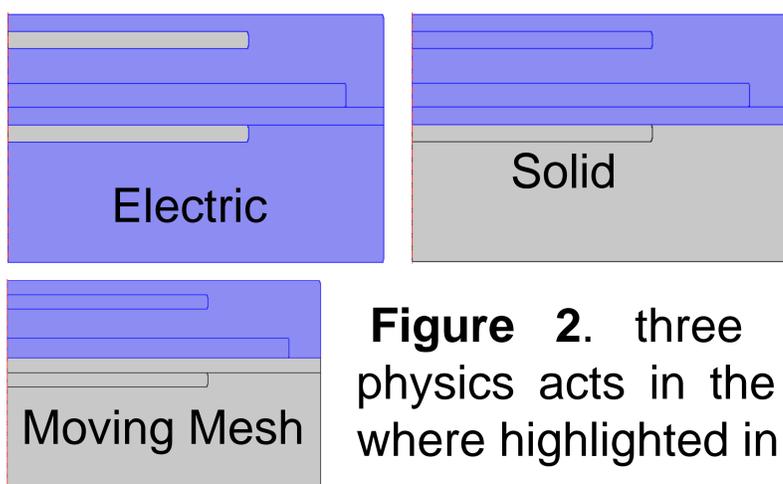
$$\sigma = \epsilon E = D$$

$$f = \sigma E = \epsilon E^2 = D \cdot E$$

$$f_x = E_x \cdot D$$

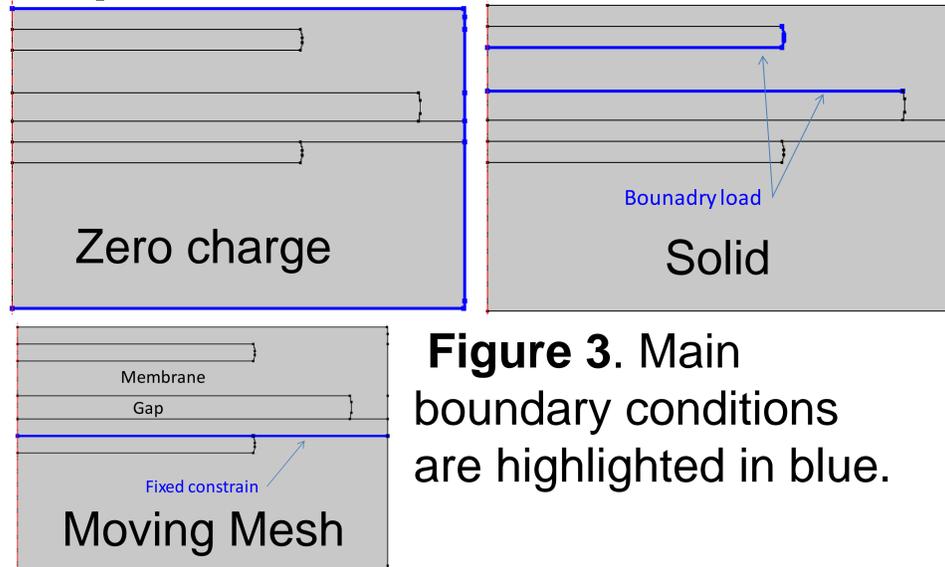
$$f_y = E_y \cdot D$$

## Physics: Domains



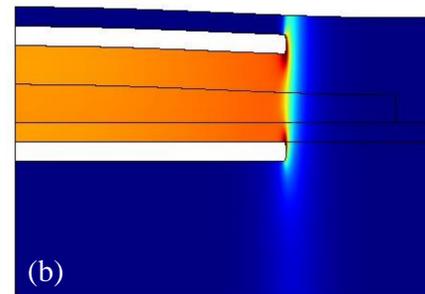
**Figure 2.** three coupled physics acts in the system where highlighted in blue.

## Physics: Boundaries

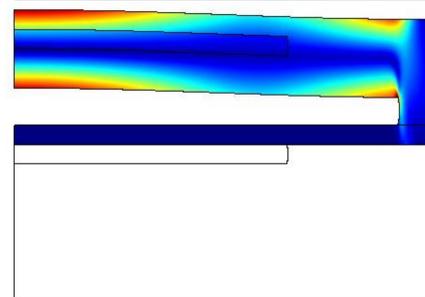


**Figure 3.** Main boundary conditions are highlighted in blue.

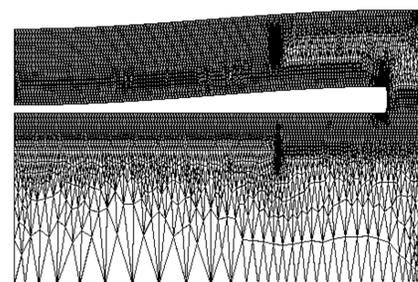
## Results



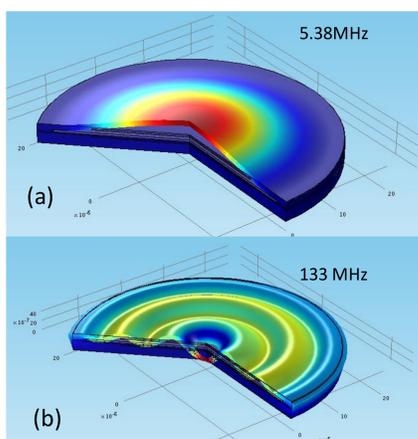
**Figure 4** Electric field distribution.



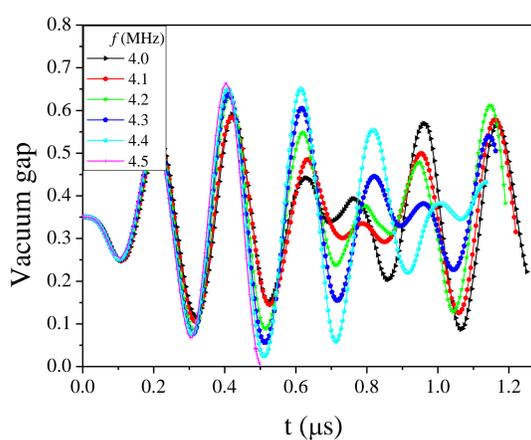
**Figure 5.** Von Mises stress distribution.



**Figure 6.** Mesh deforming with the geometry.



**Figure 7.** First two eigenfrequencies



**Figure 8.** Time evolution showing modulation and maximum frequency.