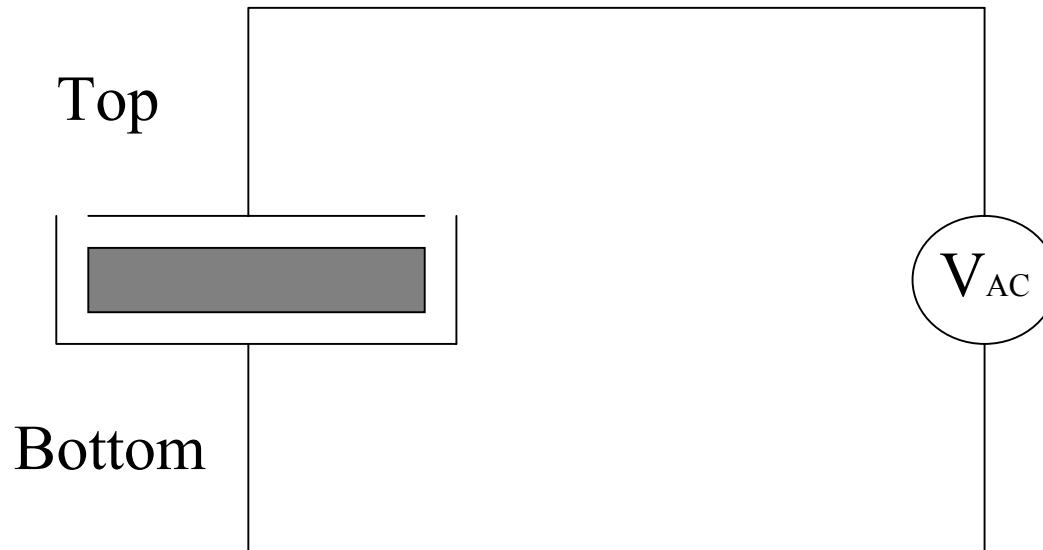


Electrostatic levitation of a conducting
mass surrounded by asymmetric
electrodes,
a minimum effort proof.

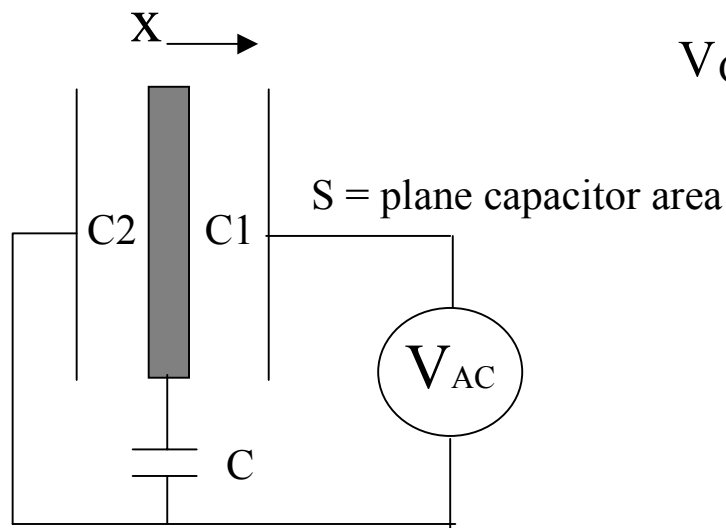
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sept. 2001*

Can this isolated conducting mass be levitated electrostatically ?

(assuming one degree of freedom and plane top and bottom electrodes.)



Exciting electrodes are the coordinate reference system.



$$V_{C1} = V \frac{C + C_2}{C + C_1 + C_2}$$

$$V_{C2} = V \frac{C_1}{C + C_1 + C_2}$$

$$Q_{C1} = V_{C1} C_1 = V \frac{C_1 (C + C_2)}{C + C_1 + C_2}$$

$$Q_{C2} = V_{C2} C_2 = V \frac{C_1 C_2}{C + C_1 + C_2}$$

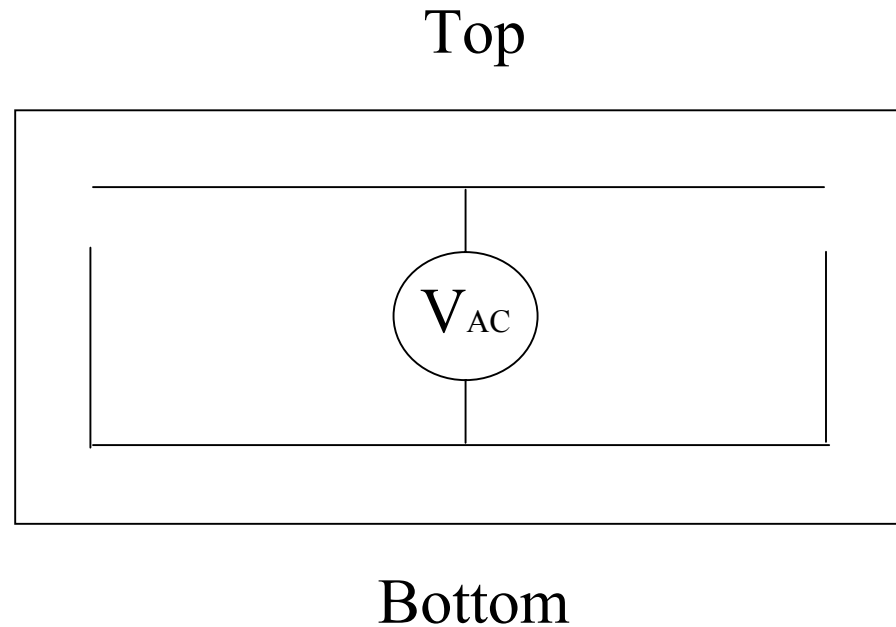
$$F = F_{C1} - F_{C2} = \frac{Q_{C1}^2 - Q_{C2}^2}{2\epsilon S} = \frac{V^2}{4\epsilon S} \frac{(C C_1 + C_1 C_2)^2 - C_1^2 C_2^2}{(C + C_1 + C_2)^2} = \frac{V^2}{4\epsilon S} \frac{C_1^2 C (C + 2 C_2)}{(C + C_1 + C_2)^2}$$

$$F > 0 \quad \text{if} \quad C > 0, C_1 > 0, C_2 < \infty, V > 0, 0 < S < \infty$$

Using plane capacitor approximation.

Assuming $C_1 = C_2$, C/C_1 is a measure of the asymmetry of the configuration. Please note that the force does not depend on the frequency: DC or transient operation is possible.

Can this isolated structured conducting mass in a conducting box be levitated electrostatically ?



The conducting box is the coordinate reference system.

Yes, please refer to the preceding example, which has identical solution.