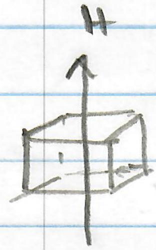
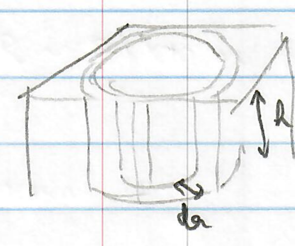
ROUGH Estimate of eddy current angular momentum via Faraday's law.



$$H = A \sin \omega t + B$$

$$V = \frac{\partial \phi}{\partial t} = \pi r^2 \frac{dB}{dt} = \pi r^2 A \omega \cos \omega t.$$

$$\Rightarrow V_{max} = \pi r^2 \omega A.$$



$$I_{max} = \frac{V_{max}}{R}. \quad R = \frac{\rho L}{A_{cs}}$$

$$A_{cs} = h\,dr, \; L = 2\pi r$$

$$\Rightarrow R = \rho \frac{(2\pi r)}{h\,dr}$$

$$\Rightarrow I_{max} = \frac{\pi r^2 \omega A h\,dr}{2\pi r \rho} = \frac{r \omega A h}{2\rho}\,dr$$

$$dJ_e = N\, m_e v_e r = N m_e r \frac{dq}{dt}\frac{dr}{dq} = \frac{N m_e r I}{\lambda}$$

λ (charge density)

$$\rho_e = \frac{Q}{V}, \quad V = L A_{cs} = 2\pi r h\,dr$$

$$N = \frac{Q}{e} = \frac{V \rho_e}{e} = \frac{2\pi r h\,dr\,\rho_e}{e}$$

$$\lambda = \frac{Q}{L} = \frac{Q}{2\pi r} = \frac{V\rho_e}{2\pi r} \Rightarrow \frac{N}{\lambda} = \frac{2\pi r}{e}.$$

$$\Rightarrow dJ_e = \frac{2\pi r^2 m_e I}{e} = \frac{\pi r^3 \omega A h\, m_e}{\rho e}\,dr$$

$$J_e = \frac{\pi m_e}{\rho e}(\omega A h) \int_0^R r^3 \, dr$$

$$= \frac{R^4}{4}\left(\frac{\pi m_e}{\rho e}\right)(\omega A h).$$

$J_{m_0} = (9.645 \times 10^{-29})\, n.$

given $f \sim 9000\,Hz$,
$K \sim 0.39\,Nm$

$A \sim 8T$, $m_e \sim 9.11 \times 10^{-31}$, $e \sim 1.602 \times 10^{-19}$
$h \sim 10^{-3}$, $\omega \sim 10^4$, $R \sim 10^{-3}$, $\rho = 50\,\Omega m$ for YIG.

$\Rightarrow J_e \approx (2.5 \times 10^{-13})(3.573 \times 10^{-13})(80)$
$\approx 7.146 \times 10^{-24}$. ($10^5$ order > J_{m_0}
need atleast 10^5 magnons!)

$\boxed{\text{(clearly YIG does not work.)}}$

or $J_e \approx \frac{3.573 \times 10^{-22}}{\rho} \approx J_{m_0}$

$\Rightarrow \rho \sim 3.70 \times 10^6\,\Omega m$. (so glass/rubber... works, but
silicon, germanium...
does not.)