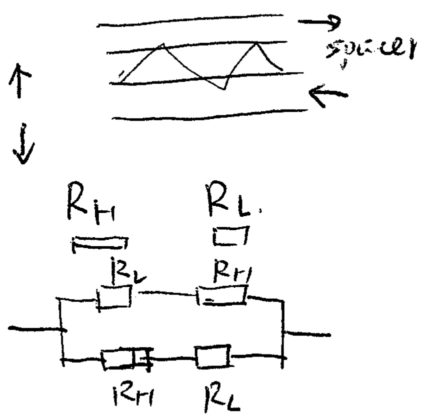
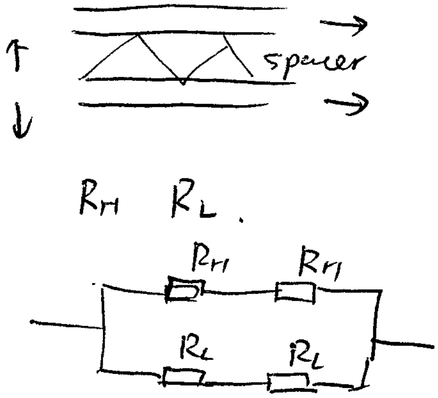
Magnetic Solution.

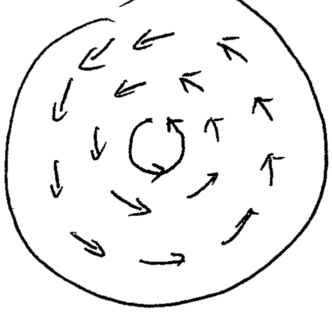
a)





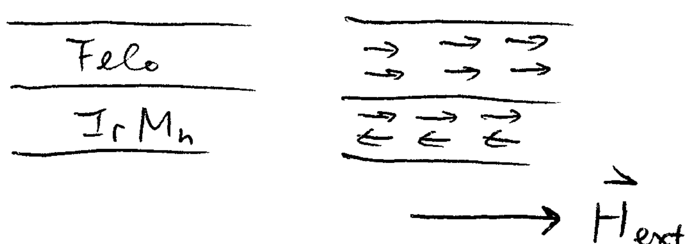
$$R_{\uparrow\downarrow} = \frac{R_H + R_L}{2} \quad > \quad R_{\uparrow\uparrow} = \frac{2R_H R_L}{(R_H + R_L)}$$

b). one domain structure



shape anisotropy leads to the magnetization in-plane.

c).

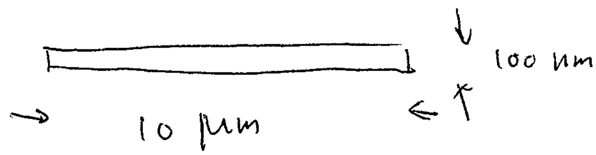


T_N. (Néel)

(T_B): blocking temperature of IrMn.

1) ~~to~~ apply the magnetic field to the desirable magnetic direction for the fixed layer
2) to heat up the sensor up to and higher than its block temperature or Néel temperature.
3) to cool down the sensor with the field applied.
4) the aligned magnetization of FeCo at the interface helps ~~re~~align the spins of IrMn at the interface,

d)



$$K_{shape} = 2\pi M_s^2$$

$$H_k = \frac{2K_{shape}}{M_s} = \frac{4\pi M_s^2}{M_s} = 4\pi M_s$$

$$H_{sat.} = H_k = 18840 \ (Oe)$$

e) To find the energy barrier for a cubic anisotropy case:

$$E = K(\alpha_1^2\alpha_2^2 + \alpha_2^2\alpha_3^2 + \alpha_3^2\alpha_1^2)$$

$\alpha_1 = \sin\theta\cos\phi$

$\alpha_2 = \sin\theta\sin\phi$

$\alpha_3 = \cos\theta$

$$E = K(\sin^4\theta\cos^2\phi\sin^2\phi + \cos^2\theta\sin^2\theta)$$

$\phi = 0$ or $\phi = 90^\circ$ $\quad E \rightarrow$ minimum

$$\Delta E = E(110) - E(100) = \frac{K}{4}$$

$$\frac{\Delta E}{k_B T} = 25 \qquad \frac{K \cdot V}{4 k_B T} = 25$$

$$\frac{4}{3}\pi\left(\frac{D}{2}\right)^3 = \frac{4 \times 25 \times 1.38 \times 10^{-16} \times 300}{6 \times 10^5}$$

$$D = 2.36 \times 10^{-6} \ (cm) \simeq 23 \ (nm)$$

f)