$$\mathrm{d}W_\mathrm{e} = \mathrm{d}W_\mathrm{p} + \mathrm{d}W_\mathrm{m};\ \mathrm{d}W_\mathrm{m} = 0 \Rightarrow \mathrm{d}W_\mathrm{e} = \mathrm{d}W_\mathrm{p}$$

$$u = Ri + \frac{\mathrm{d}\psi}{\mathrm{d}t}; \quad R \to 0;\ u = \frac{\mathrm{d}\psi}{\mathrm{d}t} \quad / \cdot i\,\mathrm{d}t$$

$$u\,i\,\mathrm{d}t = p\,\mathrm{d}t = i\,\mathrm{d}\psi$$

$$\mathrm{d}W_\mathrm{e} = i\,\mathrm{d}\psi = N\,i\,\mathrm{d}\Phi = M\,\mathrm{d}\Phi = \mathrm{d}W_\mathrm{p}$$

$$W_\mathrm{p} = \int_0^i i\,\mathrm{d}\psi = \int_0^i L\,i\,\mathrm{d}i = \frac{1}{2}Li^2 = \frac{1}{2}i\psi = \frac{1}{2}M\Phi = \frac{1}{2}\theta\Phi^2$$

$$dW_\mathrm{p} = \frac{1}{2}\Phi^2\mathrm{d}\theta + \theta\Phi\mathrm{d}\Phi = \frac{1}{2}\Phi^2\mathrm{d}\theta + M\mathrm{d}\Phi$$

$$\mathrm{d}W_\mathrm{e} = \mathrm{d}W_\mathrm{p} + \mathrm{d}W_\mathrm{mex}$$

$$\cancel{M\mathrm{d}\Phi} = \frac{1}{2}\Phi^2\mathrm{d}\theta + \cancel{M\mathrm{d}\Phi} + \mathrm{d}W_\mathrm{mex}$$

$$dW_\mathrm{mex} = F\mathrm{d}x = -\frac{1}{2}\Phi^2\mathrm{d}\theta \Rightarrow F = -\frac{1}{2}\Phi^2\frac{\mathrm{d}\theta}{\mathrm{d}x}$$

$$\theta = \frac{1}{\lambda}$$

$$\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{1}{\lambda}\right) = -\frac{1}{\lambda^2}\frac{\mathrm{d}\lambda}{\mathrm{d}x} \Rightarrow F = \frac{1}{2}(NI)^2\frac{\mathrm{d}\lambda}{\mathrm{d}x}$$

$$F = \frac{1}{2}M^2\frac{\partial\lambda}{\partial l_0}$$

$$M = 2H_0 l_0 = 2\frac{B_0}{\mu_0}l_0$$

$$\lambda = \frac{\mu_0 S_0}{2l_0} \Rightarrow \frac{\partial\lambda}{\partial l_0} = -\frac{\mu_0 S_0}{2l_0{}^2}$$

$$F = -\frac{1}{2}\frac{4B_0^2 l_0{}^2}{\mu_0^2}\frac{\mu_0 S_0}{2l_0{}^2} \Rightarrow \boxed{F = -\frac{B_0^2}{\mu_0}S_0}$$